ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

SEPTEMBER 1960

PRICE ONE DOLLAR

FOUNDED 1866

BERYLLIUM

TODAY AND TOMORROW

plus

Special Pre-Show Report

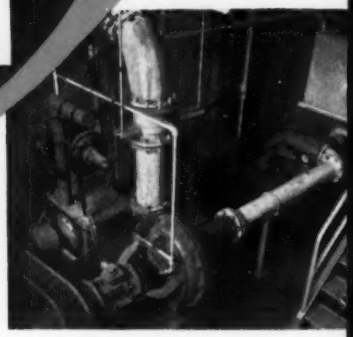
American Mining Congress

Las Vegas

October 10-13, 1960

At the "Show Place" of the iron-ore industry

fluid-solids pumping is by A-S-H pumps exclusively



In the Tailings Pump House, two C-frame pumps, a Hydroseal and a Centriseal, work in series on fluid drive. Another set is a standby.

This new iron-ore concentrating plant in Eastern Pennsylvania, the "Show Place" of the iron-ore industry, was planned modernly in every detail for more efficient, more economical operation. So, naturally, every one of the abrasives-handling pumps is an A-S-H interchangeable split-shell rubber-lined pump, either a Hydroseal or a Centriseal. Write us for illustrated brochures* that explain their individual attributes.

* For Hydroseal —Brochure No. 457
For Centriseal —Brochure No. 458

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—P.O. Box 635, Paoli, Pa.
Representatives throughout the World

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

Tires replace tracks for underground zinc-ore loading at Eagle-Picher mine

Production boosted 40%, repairs cut in half

In the sprawling, honeycombed caverns of a zinc mine 300 feet below ground, two rubber-tired Michigan Tractor Shovels are loading out 40% more ore than the crawler loaders they replaced—proving mobility is an asset anywhere—even below the earth's surface.

Owner Eagle-Picher Company's switch to Michigans here at Galena (Ill.) has produced a number of important advantages. First, they eliminated an hour of waste time every day. "It used to take crawlers 20 minutes just to creep a mile or so from our central service area to the work sites," explains Mine Supt. Ed Huoy, "and 20 minutes at the end of the day to come back again." The Model 175A Michigans make the trip, either way, in five minutes.

Triple output on scattered loading

"Also, in certain areas of the mine where loaders must carry shot rock as much as 100 ft to truckload, the rubber-shod machines often do three times the work of crawlers," Mr. Huoy continues. "The same advantage holds true when loads must be taken in succession from different headings in order to get the desired 3% blend of zinc for processing."

One Michigan keeps five trucks busy

Michigan output is high on straight loading too, according to General Supt. Harold Haman. "With trucks on average one-way haul distance to the crusher of about one mile," he says, "one Michigan loads out as much as 100 tons per hour. It alone keeps five 8-ton trucks busy. Each 8 ton load takes a Michigan three passes, two to four minutes. A typical day yields 1,400 tons of rock. Previously, with crawler loading, our top output was 1,000 tons. The daily increase, 40%."

Maintenance costs 50% lower

According to Robert Haffner, manager of Eagle-Picher's Illinois-Wisconsin operations, "Michigans not only load out more rock than the crawlers, but their cost of maintenance per ton loaded *is about half*. Shot rock, so rough that tracks and track frames required numerous overhauls, have been comparatively easy on tires. Re-capping is needed only every 1,000 hours or so.

"Before Eagle-Picher settled on Michigans, we tried other machines," continues Mr. Haffner. "After careful consideration, we decided Michigans had the sturdiness, mobility, and productive capacity we needed. We now do all loading here in Galena—and at our Shullsburg (Wis) mine—with Michigans. Four of them. So you can see how much we like them!"

Michigan is a registered trademark of
CLARK EQUIPMENT COMPANY
Construction Machinery Division

CLARK EQUIPMENT

2465 Pipestone Road
Benton Harbor 7, Michigan
In Canada:
Canadian Clark, Ltd.
St. Thomas, Ontario

Mining Calendar

Sixth Annual Titanium Metallurgy conference, New York University (Heights campus), New York, Sept. 12-13

International Mining Congress, Hungarian Mining & Metallurgical Society, Budapest, Sept. 12-18

National Mineral - Metallurgical Days, Association of Mining Engineers of Spain, Marques de Santa Cruz 14, Oviedo, Oct. 3-8

Rocky Mountain Minerals Conference, Salt Lake City, Oct. 5-7

"Third Quinquennial Alumni Reunion," Minnesota School of Mines & Metallurgy (E. P. Pfleider, University of Minnesota, Minneapolis 14), Oct. 7-8

American Mining Congress, annual meeting, Las Vegas, Nev., Oct. 10-13

Symposium on Surface Mining Practices. University of Arizona College of Mines, Tucson, Oct. 17-18

Tenth Annual Symposium on Production Drilling & Blasting, Colorado School of Mines (Prof. L. J. Parkinson), Golden, Oct. 17-19

Metallurgical Society, fall meeting, Sheraton Hotel, Philadelphia, Oct. 17-21

48th National Safety Congress, National Safety Council, Chicago, Ill. Oct. 17-21

New Mexico Mining Assn.-Southwest International Mining Assn. annual meeting, La Fonda Hotel, Santa Fe, Nov. 3-5

Electric Furnace Conference, Morrison Hotel, Chicago, Nov. 30-Dec. 2

National Conference on Water Pollution, Public Health Service, Washington, D.C. Dec. 12-14

Light Metal Industry Symposium, National Metallurgical Laboratory, Jamshedpur, India, February 1961

AIME annual meeting, Chase-Park Plaza and Ambassador Hotels, St. Louis, Feb. 26-March 2

International Symposium on Agglomeration, Philadelphia, April 12-14, 1961

Coming Up

The Rammelsberg Story — E&MJ's San Francisco editor traveled through the major mining areas of Europe several months ago. His story on the Rammelsberg lead-zinc mine and its nearly 1,000-year history is told in a full-length technical story.

Bubble, Bubble—California's gold streams are being mined again, but with a brand-new twist. Skin divers with submarine "vacuum cleaners" are bringing out pay dirt.

94th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

SEPTEMBER 1960

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Mine operator claims this fire hose has three lives

Service life jumps from 6 to 18 months with B.F.Goodrich hose

IN this underground mine, fire hose had to be replaced every six months. Acid, water and mine dampness caused cotton-jacketed hose to mildew and rot. Hose life was further shortened by constant exposure to abrasive dolomite dust.

Then a B.F.Goodrich distributor told the mine superintendent about a new industrial fire hose, developed by B.F. Goodrich to overcome just such problems. A special rubber compound was developed for the cover of B.F.Goodrich Pinnacle hose to give it high resistance to acids, chemicals, weather, abrasion and just about everything else that ruins regular hose.

After 1½ years in this underground mine, this improved B.F.Goodrich hose showed no sign of mildew or rot. The operators expected it to last far longer than any hose used previously.

The use of Dacron, a chemically produced fiber, as "filler cords" in the woven jacket makes this hose extra light, more flexible, easier to handle. It weighs only half as much as regular rubber-covered hose, takes far less storage space whether coiled or folded.

Your B.F.Goodrich distributor has exact specifications for this hose. And, as a factory-trained specialist in rubber products, he can answer your questions about the many rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. A-91Z, Akron 18, Ohio.*

B.F.Goodrich

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Articles in this issue of

ENGINEERING AND MINING JOURNAL

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93 Beryllium—not Booming, but Burgeoning

Veterans in the beryllium business say that the current surge in exploration should not be confused with the tempo of the recent uranium boom, and that the present outlook for beryllium needs "sound and sober" appraisal. Recent activity in the beryllium industry, and particularly in the areas of exploration and research, prompted the story, Beryllium—today and tomorrow. Interviews with producers, processors, the AEC and other government authorities followed. The twelve pages on the subject which appear in this issue are the result of many months of study.

The beryllium ore and concentrate market could increase from the 1959 volume of $2.25-million to perhaps $6-million per year if certain technical hurdles were cleared. Uranium mining and milling is a $290-million per year industry in the U.S.

Beryllium first broke into E&MJ's pages during the 1926-30 period, when it was reported that "beryllium occupies the same position as aluminum did 40 years ago." Also in the news at that time were the following comments: "an electrochemical process has been developed in Germany to produce 120 grams of beryllium metal per day . . . there would be no difficulty in raising this production to commercial quantities . . . its chief use would be as an alloy of copper, nickel and iron . . . metal is available in the U.S. at $200 per lb . . . a highly corrosion-resistant alloy of 70% Be and 30% Al is being studied . . . the National Advisory Committee for Aeronautics is studying beryllium as a promising metal for aircraft construction . . . (that potential led to) active prospecting for beryl ores in South Africa and the Ural Mountains. . .

103 American Mining Congress at Las Vegas

As part of its pre-show coverage of AMC's annual meeting, E&MJ is publishing the complete program of the October session, as well as the floor plan of the new exposition hall in Las Vegas. For those who do not attend, there will be post convention coverage in these pages, with emphasis on the new technology made public at the meeting.

110 Mesabi Scrubber Helps Heavy-Media Performance

Iron blast furnace operators demand better and better-grade feeds—hence all the activity in recent years in sintering, pelletizing, and the like. A relatively simple technique, scrubbing, has lately gained importance as a tool for upgrading intermediate Mesabi Range ores. Tests leading to a scrubber installation and performance of the actual scrubber installed in the plant are the subject of this article by a Cleveland-Cliffs Iron Co. metallurgist.

115 Fast Shaft Sinking in Morocco

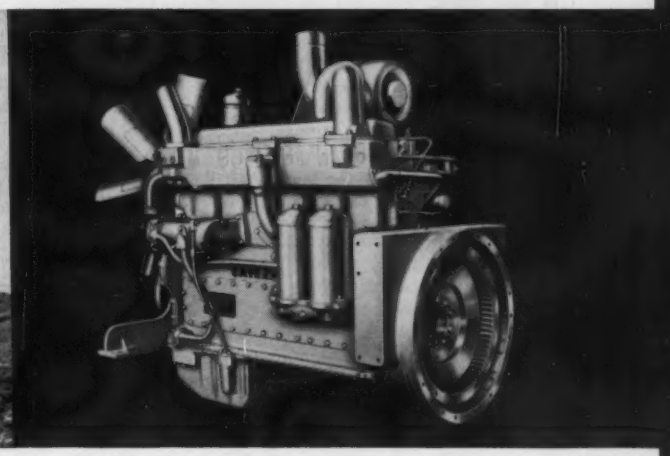
Careful cycle planning with strict adherence to schedules enabled shaft men at the El Akeba copper mine to sink and line over 800 ft of shaft in one month. Actual cycle time was only 9 minutes more than planned cycle time. This was more than compensated by an average cycle advance of 6.96 ft instead of the 6.75 ft planned, however. In view of the relatively simple equipment used, the performance is impressive.

45 New Equipment—and a Mining Show Preview

This month's New Products Digest has been expanded from its usual four pages to twelve to permit greater coverage of equipment news and to provide a selection of the equipment which will be introduced at the AMC Mining Show. We have canvassed the exhibitors at the show for their newest items and combined them with a special selection of non-exhibitors to give you the latest in cost-cutting machines and ideas.

NEW CAT NO. 14 SERIES C MOTOR GRADER

Compact engine plus many other refinements assure top performance, easier servicing, long life



Important changes make up the new Series C No. 14 Motor Grader—big improvements throughout to give you better performance, long life and servicing ease:

NEW COMPACT 150 HP ENGINE The short, rigid block and stress-relieved crankshaft give greater strength and shock resistance. New cylinder head design resists distortion yet has superior cooling characteristics. Large water pump with cast-iron impeller, ceramic seal face, and carbon type seal combined with a 20 per cent increase in radiator capacity improves cooling, lengthens life.

NEW STARTING ENGINE All-weather starting with this new two-cylinder vertical gasoline engine is assured. Replacing the horizontal engine, this design features aluminum pistons and overhead valves for improved performance. Bore is 2.38″, stroke is 2.38″, and compression ratio is 8:1. Over-running clutch in starter pinion prevents damage to starter engine when diesel starts, a year-round starting plus.

NEW SERVICING EASE An advanced fuel system is designed for easier servicing and more efficient operation. Compact fuel injection pumps with barrel and plunger assemblies enclosed in housing help reduce wear, lengthen service life.

Plus all the features that made the No. 14B the most versatile motor grader in the "big machine" field . . .

EXCLUSIVE OIL CLUTCH —provides up to 2000 hours of service without adjustment, equal to about a year of "adjustment-free" operation.

DRY-TYPE AIR CLEANER —removes 99.8 per cent of all dirt from intake air. Can be serviced in five minutes.

MECHANICAL CONTROLS —provide easy engagement. "Anti-creep" lock makes blade stay put under load.

FULL VISIBILITY —operator has unobstructed view of job even while seated.

Now, all Cat Motor Graders feature the compact engine. Like the new No. 14C, the 85 HP No. 112E, the 100 HP No. 112F, and the 115 HP No. 12E are all designed to give you the highest production at the lowest possible cost. Your Caterpillar Dealer can give you the facts and figures. He can prove it both on paper and on your job. Call him today.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

THE NEW NO. 14C MOTOR GRADER— MADE FOR THE BIG JOBS

94 YEARS OF MINING

The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.

MONTANA, MAY 1866—In consequence of the recent depredations of the Blackfoot tribe, a great stampede among Bentonian squaws is reported —the dusky mistresses leaving the good "much-a-muck" of their white lords, and seeking the campfires of their blood kin.

NEVADA, MAY 1866—From the Grass Valley SENTINEL: Ragsdale & Co. have struck an immensely rich ledge, southwest of the Globe Ranche, near the celebrated Stockton lode. They have been taking it out rich for several days past, but on Saturday struck it richer than ever, and took out $1,000 in a few hours.

CALIFORNIA, MAY 1866—The idea of crushing the cemented placer dirt in stamp mills was suggested at Forrest Hill. Messrs. C. H. Dewey & Co. erected a substantial mill on their claim . . . an outlay of $8,000 . . . has proved most profitable as the firm have realized large dividends, and recently sold out at prices varying from $10 to $12,000 per share.

IDAHO, MAY 1866—From the Boise City correspondent: In the Yuba District, eighteen miles northeast of Rocky Bar, the ledges are astonishing, and it is likely to produce a smile of skepticism, and a doubt of my credibility, were I to tell the whole truth . . . I have seen assays of rock from Yuba from $17 to $2,000 to the ton in gold, besides paying quantities of silver.

IDAHO, MAY 1866—From the Boise City correspondent: Benson, Harris & Co.'s ten stamp mill, after six days' run on rock from the Wide West lode, cleaned up over one hundred pounds of gold, (after retorted,) worth, say in cash, $16,500.

MICHIGAN, 1866—On April 18, the trammers at the Pewabic mine struck for an increase of wages from $38 per month to $45. They eventually concluded to continue on as before.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

There must be something about our face. People are forever telling us stories in which some individual has risen up and struck back at the fates, The Organization, or the machine, on the assumption that we delight in such tales.—And they're dead right.

The following was passed along by a printer friend, and is a welcome addition to the collection.

"A man who had decided to give himself a long overdue vacation approached his bank for a loan to finance it. The officials refused to lend him the money for such a purpose. Disgusted and indignant, he stormed out of the place and headed for another bank down the street. The officials of the second bank readily granted the loan. He made up his mind to go back to his old bank and tell its officers what he thought of them, but on the way he got another idea. He stopped at a fish store and bought a five-pound fish which, carefully wrapped, he deposited in his safe deposit box, emptied for the purpose. Then he left for a six months' trip to Europe."

It reminds us of a true story concerning a mining company executive here in town. He received a package from a friend one Friday afternoon, just before his departure for a two-week trip. He was impressed with his friend's solicitousness—the package came marked "rush" and was delivered by the speediest method. But, the last-day-before-taking-off being what it is, our man had the box tossed into a closet for his return.

That joyous homecoming, 14 days later, was marred by the unhappy mood of the office staff, the anguish of a secretary, and the subsequent discovery of two dead pheasants, fresh-killed a fortnight before.

Don't ask. Water torture couldn't make us identify the man.

Our favorite story of the genre comes from the NEW YORKER magazine. It concerned a lady who, after several years' membership in a book club, decided to resign. When she received the next notice, in the form of an IBM-type card, she politely returned it with a note that she did not want the current book, nor any more books at all, thank you.

Within a few weeks, the book came. She returned it, with another polite note. The next month, despite her effort, another card with another offering.

Our friend started to write a third, and probably less polite, note when she was suddenly struck with the conviction that she was taking the wrong tack. It was pointless to keep writing to mere humans. One had to get through to the machine. Then, with what amounts to sheer genius, she borrowed her young son's paper punch, took a few random shots in various portions of the card, and mailed it off.

Book club and machine lapsed into a beatific silence which the lady enjoys (deservedly) to this day.

Our old friend the beachcomber belongs, in his own small way, to the company we admire, and offers gallant resistances whenever possible.

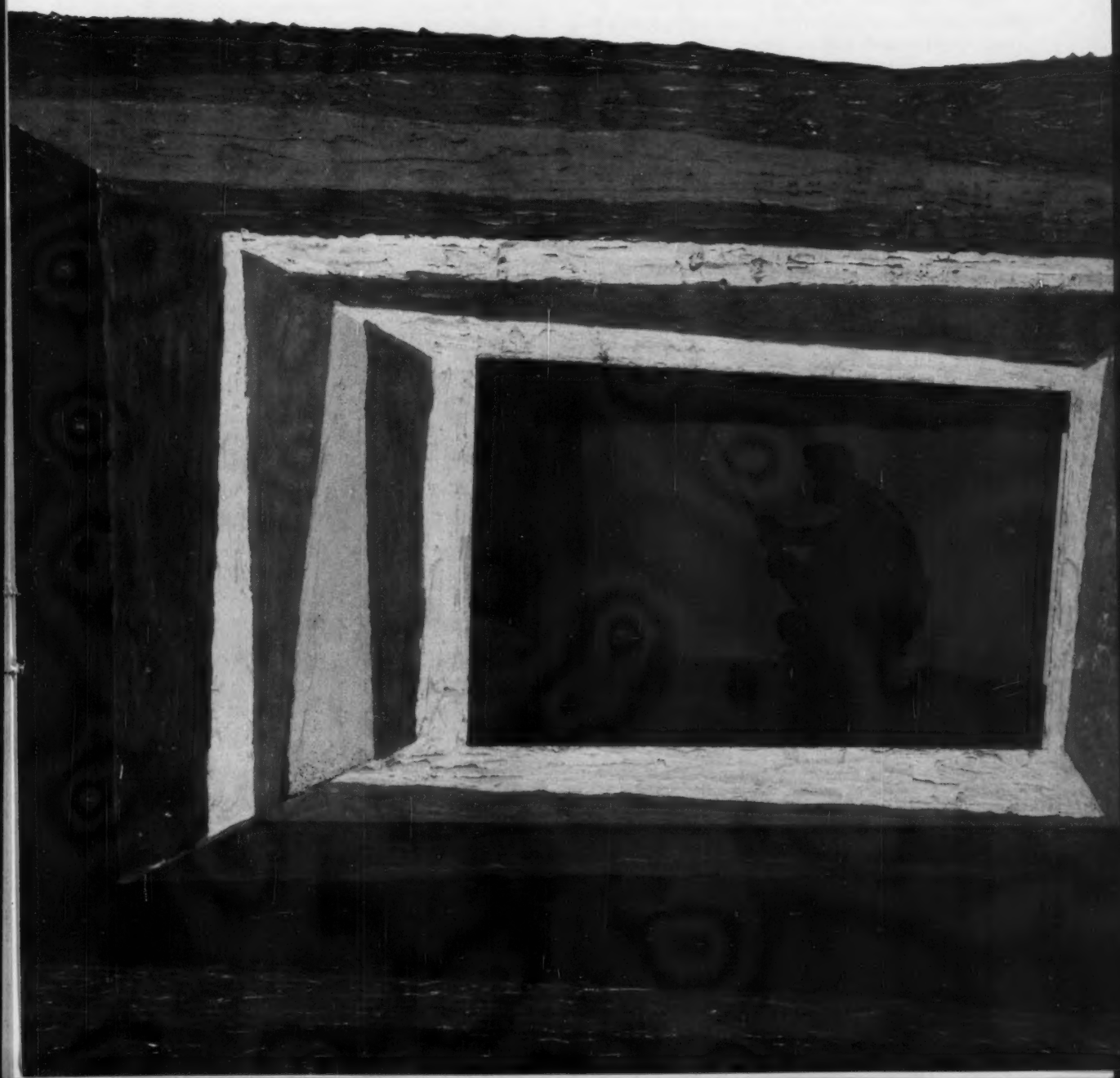
He never, for instance, tears along the dotted line, knocks and then enters, nor waits for the dial tone.—And when it says "Rub, don't blot," he blots.

THIS IS MSA: Fire Fighting Equipment • Rock Dusting and Dust Collecting • Illumination • Electronic Communication and Control Respiratory Protection • Artificial Respiration Equipment • Personal Protective Wear • First Aid Equipment • Permanent and Portable Instruments

Prevention is the best control for mine fires . . . but, if a fire starts, immediate use of on-the-spot equipment keeps it under control. Then, major fire fighting equipment can be brought up and completely extinguish the fire. MSA has the products that give you this kind of fire protection.

M-S-A® Dry Chemical is a specially prepared sodium bicarbonate for instant mine fire control. Available in 60-pound bags, it can be stored at vital fire control locations. Should fire occur, Dry Chemical can be spread immediately by M-S-A® Rock Dust Distributors, shovel or, even by hand. It plugs the crucial time gap until large capacity fire trucks arrive. M-S-A® Fire Trucks, available in various sizes, provide the capacity needed to extinguish fires.

Call your MSA representative for additional information. Or write for helpful literature. Mine Safety Appliances Company, 201 North Braddock Avenue, Pittsburgh 8, Pennsylvania. In Canada: Mine Safety Appliances Company of Canada Ltd., 500 MacPherson Avenue, Toronto 4, Ontario.



"'Live track' power steering rock...SO WE KEEP OUR TD-25

—Asheville Contracting Company,

Shale and blue granite rock make up 85% of the 550,000-cu. yd. of roadway excavation on this contract —5.18 miles of Blue Ridge Parkway construction, for the United States Department of Interior.

That's why Asheville Contracting Company places maximum reliance on their "rock-movers' special": king-sized International crawler power! Where the going's too tough or job progress is too slow and costly with big clutch-steered crawlers, "Asheville's" new 230-hp TD-25 and two veteran TD-24's take over—and "run interference."

"International 'live track' power steering moves more dirt and rock," states M. H. Reighard, Superintendent of rock operations for "Asheville." "Therefore, we keep our TD-25 and TD-24's on trail-blazing and pioneering. The 'live track' feature keeps the blade in the material and makes steep work safer. TD-25 balance enables working 'almost straight up' on mountainous terrain."

Exclusive, years'-proved International Planet Power-steering gives you full-time live power on both tracks to handle full loads on turns as well as straightaways. Load-limiting "dead-track drag" is eliminated. And

moves more PIONEERING"

Asheville, No. Carolina

"live track" power-steering is combined with on-the-go, Hi-Lo power-shifting that lets you match power to load instantly, for full-speed cycles. You do away with time-wasting "gear-shift lag!"

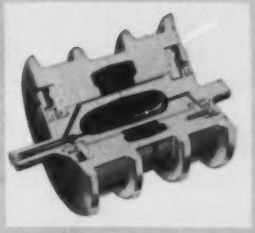
New TD-25 seven-roller tracks are strength-matched to the full effort of the high-torque, 230-hp turbo-charged Diesel engine! The "25" is platformed on shock-resistant, double-box-beam track frames—smoothly carried on International's dual-protected Dura-Rollers, the track rollers that make 1,000-hr. lube intervals practical!

As standard equipment at no extra cost, the TD-25 gives you exclusive, combined Planet Power-steering and Hi-Lo on-the-go power-shifting. And you get this work-speeding design advantage in torque-converter or direct drive model. Here, Asheville's "25" operator is ready to "shift-up" to keep the load on the move.

Power-steer and power-shift the TD-25 with king-sized loads—around curves, upgrade, anywhere! Compare planet-powered "25" ability to deliver full-load capacity, full-time—to outearn other big rigs up to 50%—blading rock, benching, push-loading, mass-production dozing (where fast reverse and decelerator action count), ripping shale! Let your International Construction Equipment Distributor demonstrate!

Even with an enormous offset load of shot-rock there's no "bank-nosing;" no sluing. The TD-25 operator simply operates the load-side track in high-speed range—the other track in low-speed range. Result: full-capacity, straight-ahead performance—the same as the "25" gives on benching, bank-cutting, or side-casting!

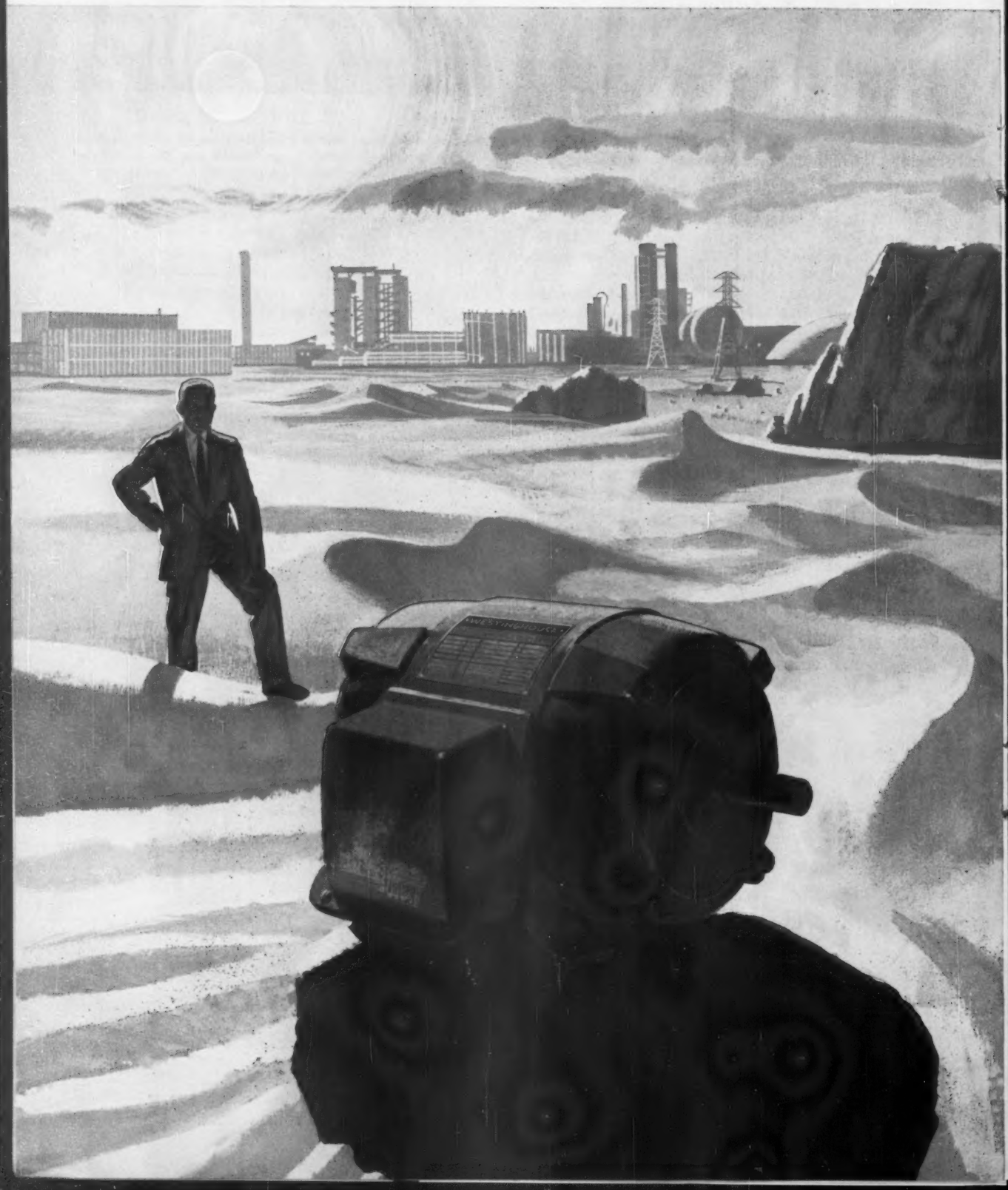
Heavy-duty TD-25 Dura-Rollers feature thick, deflection-proof shells; full-floating, precision fitted seals; king-sized lube reservoirs; and exclusive pressure-relief passages that protect seals from overlubrication. These minimum-maintenance track rollers give you practical 1,000-hr lubrication intervals!



International® *Construction Equipment*

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Ill.
A COMPLETE POWER PACKAGE

NEW WESTINGHOUSE *Guardistor*



MOTORS LET YOU USE ALL THE HORSEPOWER YOU PAY FOR...SAFELY

The man and the motors from Westinghouse now provide absolute protection against motor failure caused by excessive heat . . .

Our Engineering Manager says:
"With the breakthrough development of the Westinghouse Positive Temperature Coefficient thermistors, for the first time we can provide inherent protection against motor failure caused by excessive heat. The solid-state thermistors buried in the windings instantly sense excessive heat from any cause and simultaneously warn of trouble or automatically take the motor off the line. Thus, motor protection is placed where only true motor protection can be . . . in the windings."

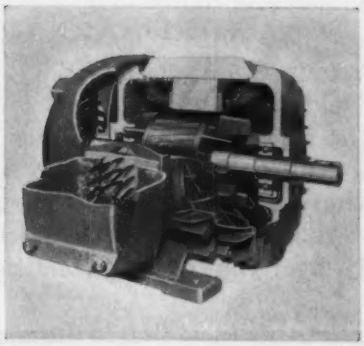
Our Marketing Manager says:

- "You can match the motor to the load . . . use all the motor you are paying for.
- Provides positive protection based on winding temperature . . . *not* load current and/or power supply fluctuations.
- Eliminates time and expense of changing winter-summer heaters. No nuisance tripping, it's fail-safe . . ."

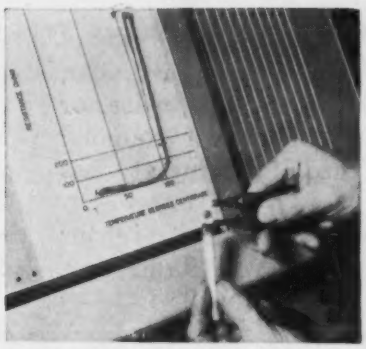
Call your Mr. Westinghouse for the application of a Guardistor* motor to your drive requirements . . . write for *Questions and Answers About . . . Guardistor* (B-7876). Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse.

*Trade-Mark
J-22160-RI

See a demonstration of the Guardistor motor at Booth 310, American Mining Congress, Oct. 10-13, Las Vegas, Nevada.



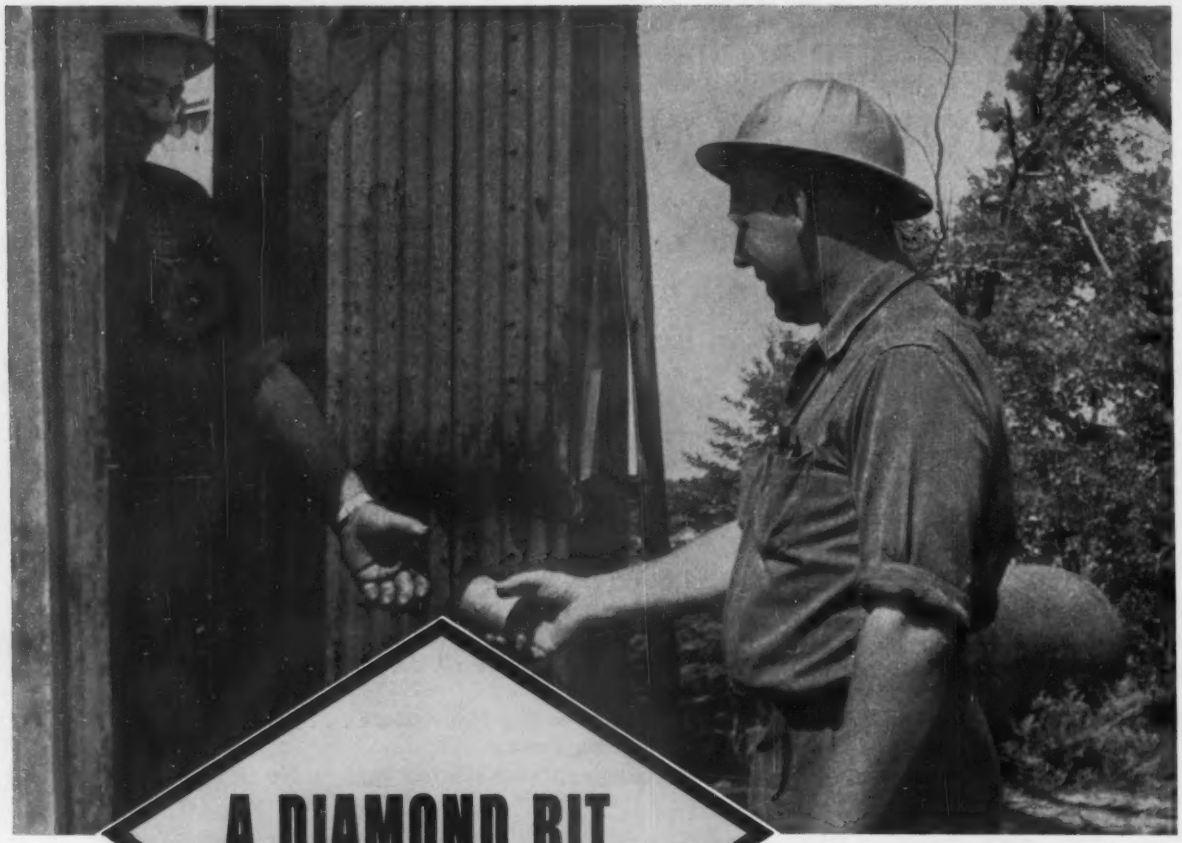
Unlike remotely located sensing devices, PTC thermistors are buried in the windings of the Guardistor motor, instantly equating all temperature factors.



Ever alert PTC thermistors constantly totalize temperature, statically triggering an action *only* if critical temperature is reached.

MOTOR & GEARING DEPARTMENT

Westinghouse



A DIAMOND BIT...

Custom designed by Christensen for your drilling requirements

Whatever your drilling needs—underground or on the surface, exploration or blast holes, shallow or deep drilling with air, water or mud—you'll find that Christensen Diamond Bits are your assurance of drilling at "less cost per foot."

Christensen Diamond Bits cut straighter holes, last longer and cut even the hardest rock economically.

And, regardless of your job location or scope of operations, there's an experienced Christensen field consultant available to recommend the right "custom designed" bit for your job. This means that you can be confident that the diamond size and pattern, waterways, matrix hardness and bit style correctly meet your drilling conditions.

"Less cost per foot."

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To obtain faster penetration, straighter holes, better diamond usage, unequalled service and experienced consultation, contact Christensen.

OUTPUT—

HOW DO YOU FIGURE IT?

—by the hour
—by the day
—or by the month

S-80-10-L

Anyone who comes into a mine or quarry, even a man unfamiliar with such an operation, can immediately sense any presence of trouble. Idle trucks and silent engines scream of loss.

Real Money-Making Output isn't produced with flash-in-the-pan operation. It isn't the result of hoist line speed, engine horsepower or any other *one* thing. Money-Making Output is the result of the perfect synchronization of smooth action, dependable power and versatile ability through easy, accurate control, whether it's setting steel or digging rock.

Don't take our word for it—ask Northwest owners! Northwests stay on the job! *They are always ready to go. We hear it everywhere, and Northwest owners will tell you so.* The smooth coordination of action between assemblies for machine movements—the Northwest Dual Independent Crowd that utilizes force most other independent crowd shovels waste—the easy, accurate control of the drum clutches through the Feather-Touch Clutch Control, with its true *feel* of the load—the precision in handling and spotting loads made possible by the smooth acting Uniform Pressure Swing Clutches—and the many other Northwest advantages backed by Northwest ruggedness of construction take output beyond mere hourly production.

Here is the versatility, stamina and performance to deliver—not just hour-by-hour but day-by-day and week-by-week—a high *monthly* output. Ability to stay on the job and high output are the reasons why one out of every three Northwests sold is a repeat order.

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EFFICIENT...

WILLISON COUPLERS

The Willison has only four moving parts.

SAFE...

WILLISON COUPLERS

No need for men to go between cars to couple or uncouple.

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WILLISON COUPLERS

Coupler head and shank are one-piece steel casting with over 400,000 pound ultimate strength.

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Used on all types of mine cars and locomotives; with accessories, can couple with link-and-pin hitchings; can be used with cables on incline haulage or odd pulling requirements.

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Over 100,000 Willisons in service in the U.S. and overseas.

- Rubber Cushioned Units
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- NACO Steel Wheels
- NACO Steel Links and Swivel Hitchings

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Cleveland 6, Ohio

International Division Headquarters
Cleveland 6, Ohio

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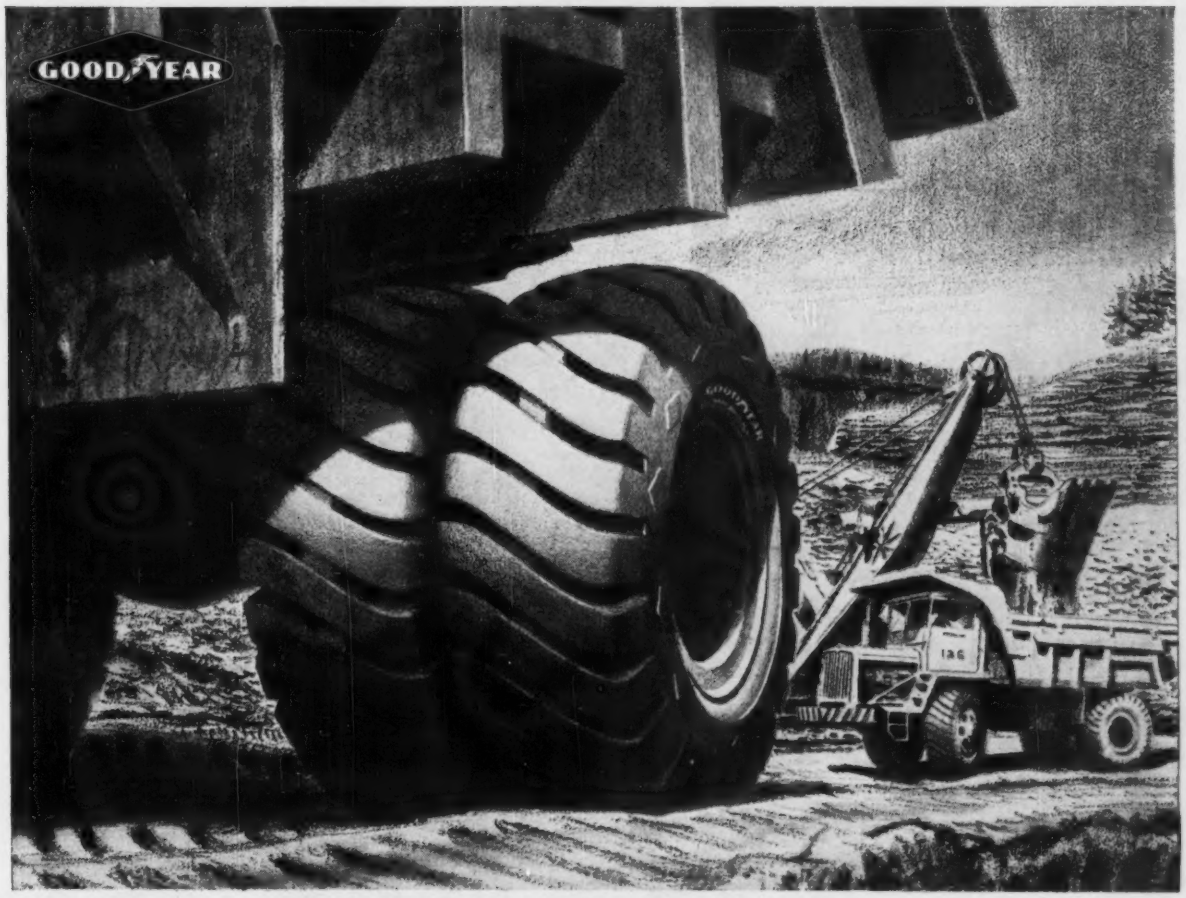


XTRA-TOUGH TREAD

New Hard Rock Lug Xtra Tred takes it when the going's toughest!

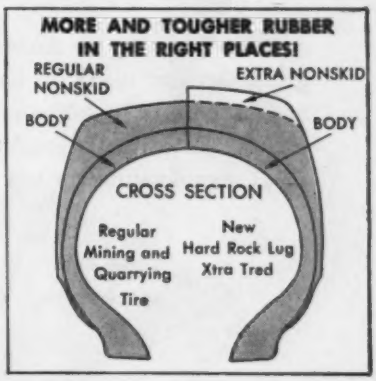
Here's the all-time stand-out tire for mine and quarry work. And Goodyear technology made it possible.

For instance, the thicker nonskid tread (up to 70% thicker than conventional tires) gives you hard-gripping getaways. Then, too, this rubber – specially compounded with super-toughening agents–shrugs off cutting, chipping and puncturing objects to give you the xtra-tough tread you need for rock work.

And, because it's made with 3-T Processed Nylon Cord – triple-tempered by Tension, Temperature and Time–the Hard Rock Lug Xtra Tred offers far greater resistance to bruises and breaks.

Summed up – this super-tough tire helps you take out pay loads *fast* – and at *low cost*. And it pays you the added dividends of less upkeep and more recaps.

Why not ask your Goodyear dealer for the full story today? Or, write: Goodyear, Truck Tire Department, Akron 16, Ohio. Remember, *lots* of good things come from Goodyear.



The World's Toughest Truck Tires by

GOODYEAR

Xtra Tred–T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Visit CF&I

When you're at the American Mining Congress, October 10 - 13, in Las Vegas, drop in at CF&I's booth 1004. The exhibit will feature the complete line of quality steel products CF&I manufactures for the Mining Industry. Engineers will be on hand to answer any questions you may have, or you are welcome to use our message center, make phone calls, use our secretarial service, or just relax in a pleasing atmosphere. 7853

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MINING PRODUCTS–BOOTH 1004

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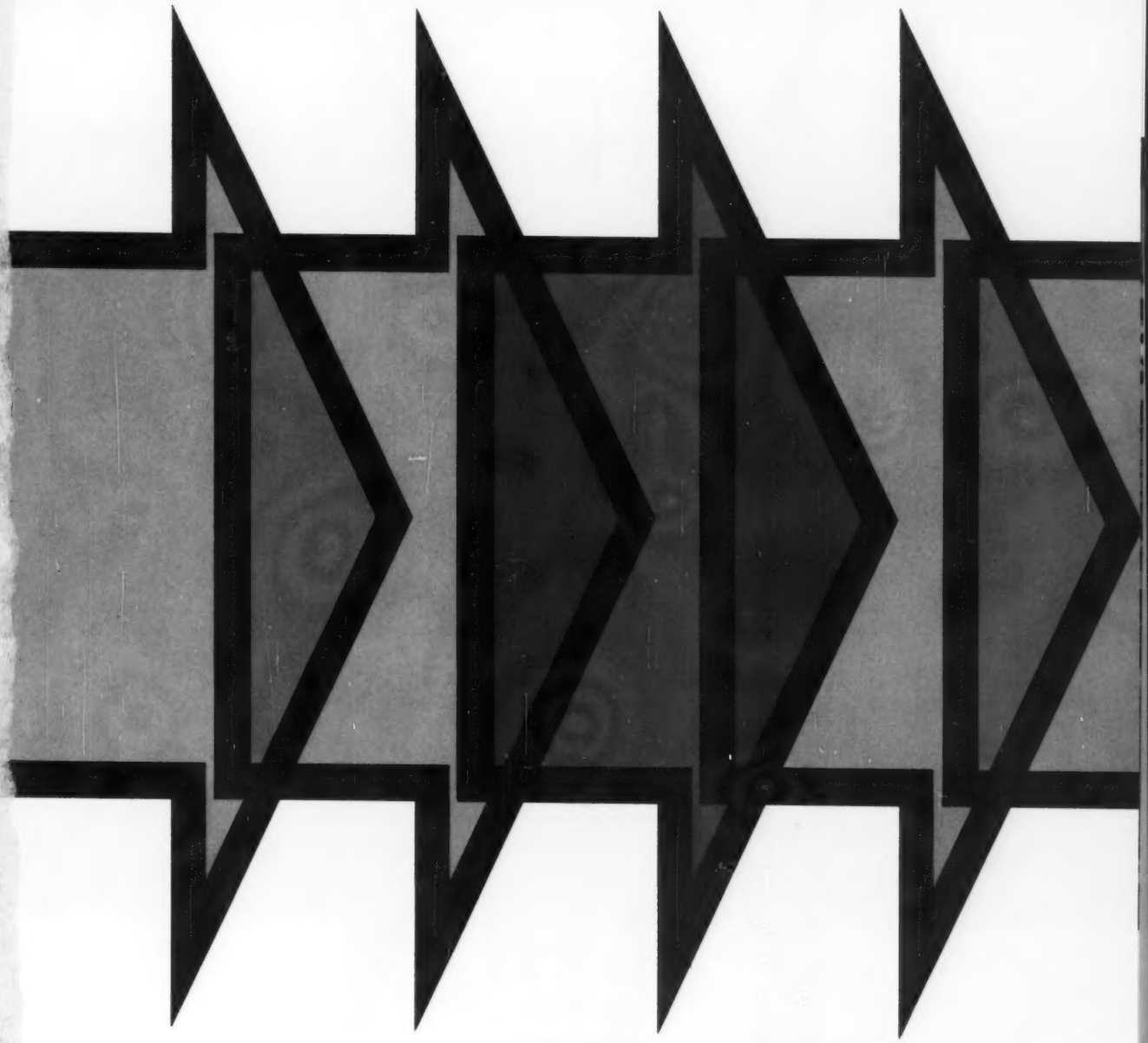
CF&I STEEL

In the West: **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso • Ft. Worth • Houston Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Leandro • Seattle • Spokane • Wichita
In the East: **WICKWIRE SPENCER STEEL DIVISION**—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia



FROM GREAT LAKES STEEL

15 X-A-R 30

ABRASION RESISTANT STEELS

TWO NEW STEELS—HARDER FOR HARDER JOBS

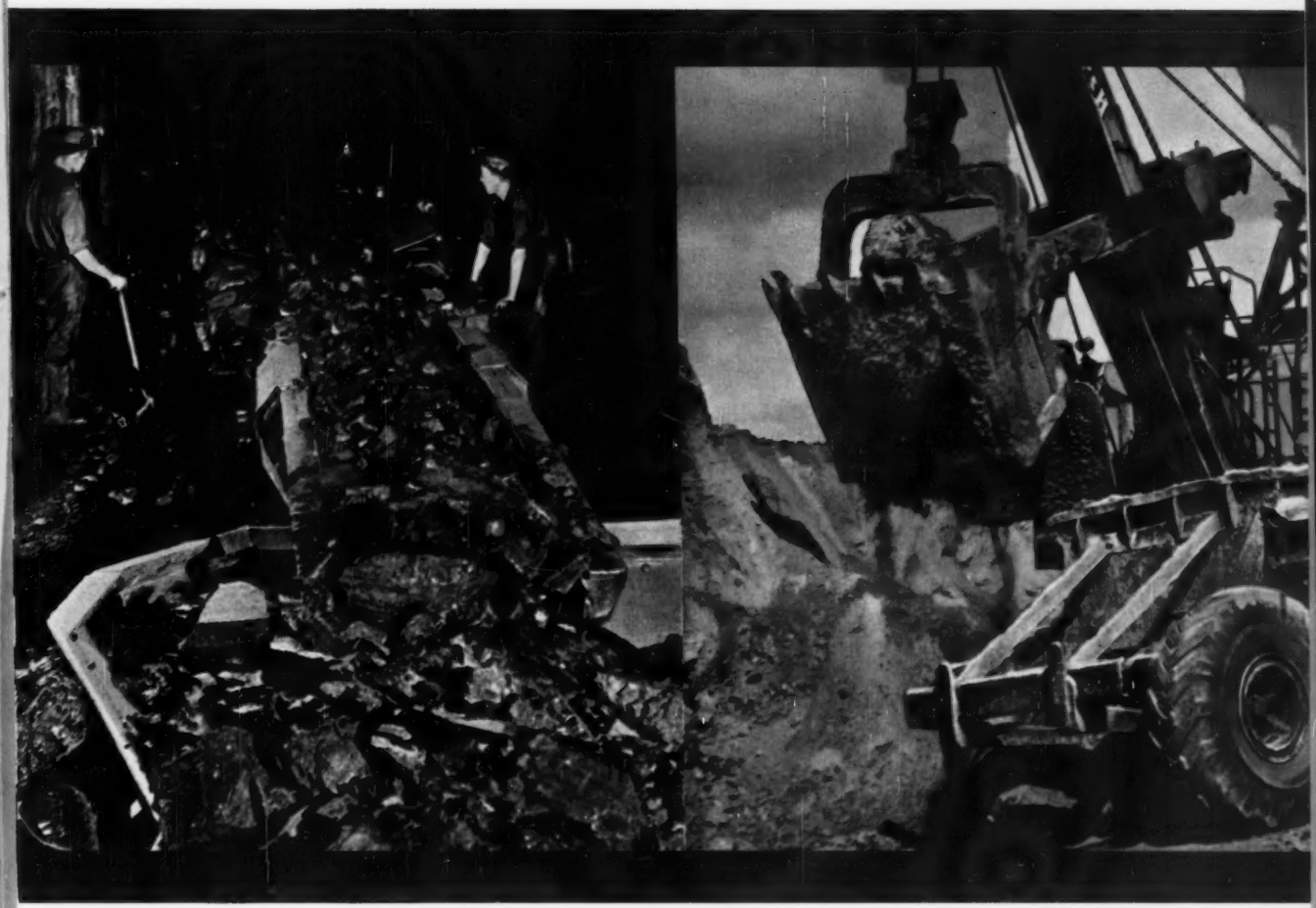
X-A-R

ABRASION RESISTANT STEELS

HARD ENOUGH AND TOUGH ENOUGH TO LAST

Is abrasion your constant enemy? If your equipment meets materials as they're scooped, shoved, slid, pushed, dragged or dumped, does it face the recurring threat of downtime for repairs or replacement? To eliminate such maintenance headaches, Great Lakes Steel has developed two tougher, harder alloy steels—X-A-R 15 and X-A-R 30. They're supplied in hardnesses from 360 to 400 BHN (or, by agreement, in a range of hardness between 265 and 500 Brinell). And they're especially effective and economical in those critical bear-the-brunt areas of the equipment where wear is worst—liners, teeth, bars, blades and plates, for example. *Under conditions that commonly wear out equipment in a hurry, X-A-R abrasion-resistant steels outwear any other type of steel.*

Great Lakes Steel is a division of



WHERE MATERIALS COLLIDE WITH EQUIPMENT

Chemical composition alone is not the secret of low carbon X-A-R steels; their balanced combination of uniformity, high strength, hardness and toughness is the result of close control during heat-treating, quenching and tempering. This makes them more workable, too. Under normal welding and fabricating conditions use X-A-R 30. For *extremely* difficult problems, such as welding under cold conditions or extensive flame cutting, choose X-A-R 15.

X-A-R abrasion resistant steels are immediately available in ⅛″ to 1″ thicknesses, widths up to 72″ and lengths up to 35′. For technical information and supply sources, see next page.

X-A-R

A PRODUCT OF

GREAT LAKES STEEL

Detroit 29, Michigan

NATIONAL STEEL CORPORATION

15 X-A-R 30

TECHNICAL INFORMATION

CHEMICAL COMPOSITION

X-A-R steels are furnished at two specified carbon ranges. These are 14 to 20 carbon for X-A-R 15 and 25 to 30 carbon for X-A-R 30. The balance of the typical composition is:

Manganese	.80%	Chromium	.65
Phosphorous	.020	Molybdenum	.20
Sulphur	.028	Zirconium	.06
Silicon	.60		

TYPICAL MECHANICAL PROPERTIES

	At Brinell Hardnesses of: 363	400
Tensile Strength, psi	180,000	200,000
Yield Strength, psi	165,000	180,000
% Elongation in 2"	17	16
% Reduction in Area*	56	55
Charpy V Impact at —75°F.	12 (Ft. Lbs.)	7

*Based on standard .505" specimen

ENGINEERING DATA

Resistance to Atmospheric Corrosion (Rural, Marine, and Industrial Environments)	3-5 times copper-bearing or carbon constructional steel
Compressive Yield Strength, psi	Approx. equal to Tensile Yield Strength
Ultimate Shearing Strength, psi	Approx. equal to Tensile Yield Strength
Modulus of Elasticity, psi	29/30,000,000
Endurance Limit (rotating beam)	60% of Tensile Strength
Coefficient of Expansion per °F.	70°F. to 200°F.—.0000062

FABRICATION

Cold Bend Test: Moderate bending can be performed within the usual range of hardnesses. For free bending, it is recommended that a mandrel be used not less than ten times the thickness of the metal through an angle of 90°.

Welding: Low hydrogen electrodes are recommended for welding X-A-R steels. The grade of electrode used is dependent on the strength requirement of the weldment.

Burning: X-A-R steels can be flame cut without pre-heating or stress relieving after cutting.

COMPLETE METALLURGICAL SERVICE

In addition to the information given in this folder, there is a great deal of detailed data available to steel users covering all characteristics of X-A-R steels. Furthermore, a thoroughly competent metallurgical service organization is available to work with you on any application problem you may have.

X-A-R STEELS ARE AVAILABLE AT THESE STEEL SERVICE CENTERS

BENEDICT-MILLER
Lyndhurst, New Jersey

JOSEPH DEMSEY COMPANY
Cleveland, Ohio

DUCOMMUN METALS & SUPPLY COMPANY
Los Angeles, California

INTERSTATE STEEL COMPANY
Evanston, Illinois

LOCKHART IRON & STEEL COMPANY
Pittsburgh, Pennsylvania

MARSH STEEL & ALUMINUM COMPANY
Kansas City, Missouri

O'NEAL STEEL, INCORPORATED
Birmingham, Alabama

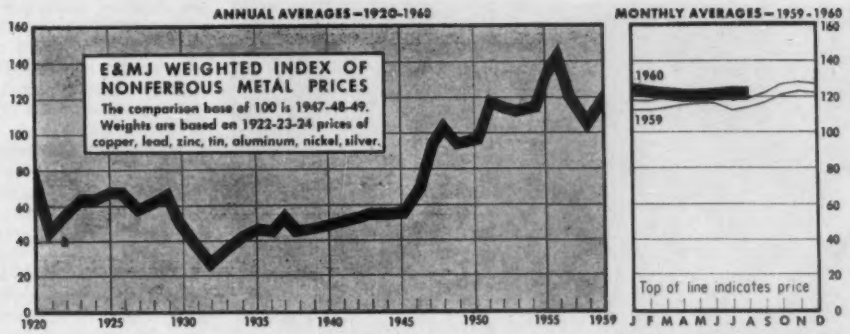
SALT LAKE HARDWARE COMPANY
Salt Lake City, Utah

A. C. LESLIE & COMPANY, LIMITED
Montreal, Canada

15 X-A-R 30
ABRASION RESISTANT STEELS

E&MJ OUTLOOK

PRICES



MARKETS

Another month was added to the 20th-month period of nonferrous metals price stability (see chart above.) E&MJ's index for August was 126.0, as compared with 126.1 for July.

•

AT HOME

A "potentially significant" deposit of beryllium ore was found near Glen's Peak, Idaho, according to U.S. Bureau of Mines and the Idaho Bureau of Mines and Geology. Ore occurs in a two-foot fissure of aquamarine beryl mineral in a pegmatite dike.

Rep. Al Ullman of Oregon, plans to introduce legislation in early 1961 for incentive payments to encourage domestic production of gold. Ullman said that this approach is "an increasingly possible answer to the mounting problem of gold withdrawals from this country."

Bunker Hill Co.'s newly completed $2-million phosphoric acid plant near Kellogg, Idaho, has a rated capacity of 130 tons per day of phosphoric acid. The plant will provide an outlet for the sulphuric acid produced at the company's zinc plant nearby.

Research to date on the use of spent sulphite liquor from paper mills in the processing of taconite pellets has been sufficiently encouraging at Michigan College of Mining and Technology to warrant additional funds to continue the investigation.

Cryogenerators Inc., Ashton, R.I., has built a Norelco hydrogen generator that will produce 1,000 cu ft of hydrogen per hr so economically that it will be attractive for use in the hydrogen reduction of metals by small manufacturers.

•

LABOR

Mine-Mill announced in late August that "the demand for a shorter work week must now be given top priority by the American labor movement." Other targets include requirement that companies should bear the expense of relocating and retraining workers displaced by technological change; and higher pensions and earlier retirement for older workers to create additional job opportunities.

•

ABROAD

An agreement between Soviet Russia and Ghana has been signed providing for economic and technical cooperation. Trade agreements were also concluded. Soviet help will include geological exploration for oil and other mineral resources.

A nickel pilot plant to process nickel ore is under construction in the Dominican Republic. A Canadian-Dominican enterprise, Mineral y Beneficiadora Falconbridge, is exploring the back country of the republic where nickel reserves comparable to those in the Sudbury district of Canada are said to exist.

Nchanga Consolidated Copper Mines Ltd. hopes to increase copper production by 15,000 tons per year in Northern Rhodesia without increasing the mining rate. Plans for a $5.6-million to $8.4-million improved and expanded leaching plant to permit this increase are under study.

THIS MONTH IN MINING

PRESIDENT OF THE CONGRESS, Dr. Arne Noe-Nygaard, welcomes the members in six different languages. Geologists from more than 100 countries attended.

Three Thousand Geologists Crowd IGC in Copenhagen

A DISAGREEMENT concerning volcanic activity on the moon marked the opening 21st session of the International Geological Congress, in Copenhagen. Three geologists, Dr. Bülow from East Germany, Dr. Green from USA, and Dr. Schlichta from USA, agreed on the volcanic origin of the craters of the moon. However, Dr. Green was opposed by his German colleague when he maintained that the moon is still volcanically active.

Dr. Green based his theory on new photographs from the Russian professor Kozyrev and on the fact that the temperature on top of the craters is about 60° higher than in the neighboring areas. The three men did agree that a geologist ought to be among the first humans to land on the moon.

Succeeding meetings at the session produced papers more directly related to mining, especially in the field of geophysics, geochemistry, and origin of ore deposits. Some of these (abstracted below) include: (1) the value of wire-line well logging to determine underground structures, (2) the use of trace elements in swamp material as a guide to buried ore deposits, (3) a determination of diffusion rates for sulphide ores, and (4) a determination of the metal content of primary ore solutions.

Over 3,000 geologists from more than 100 countries crowded Copenhagen University, Copenhagen Technical High School and several other large meeting places. More than 400 papers were presented at the sessions. The papers, as well as a volume of abstracts, will be available from the Congress.

Wire-line well logging can give bed thickness, porosity, water saturation, salinity of formation water, formation dip, and indications of permeability, with methods used by H. G. Doll, Maurice Martin, and M. P. Tixier of the USA.

Log correlation between wells makes possible the construction of stratigraphic and structural cross sections and the definition of folds, faults, unconformities and facies changes. In addition the logs often furnish direct evidence of faults, unconformities, sediment compaction, and depositional conditions.

Trace elements in organic soil guided geochemists to a buried pyritic copper deposit at Captain Mines, Bathurst District, New Brunswick, Canada according to H. E. Hawkes and M. L. Salom of the USA.

Well-defined dispersion patterns of iron and copper were mapped by analysis of swamp material. The patterns, as determined both in live moss and in dead organic matter, are displaced in the direction of movement of swamp water. Iron and copper were determined by X-ray fluorescence analysis, a method that has several practical advantages over wet chemical methods.

The migration of chemical elements as a theoretical basis of geochemical search methods was explored by A. A. Saukov of the USSR. Migrating chemical elements during the formation or destruction of a deposit form syngenetic and epigenetic dispersion aureoles. Of interest is the behavior during the migration processes of accompanying elements, which, in a number of cases, are more convenient indirect indicators of deposits than the direct indicators.

Diffusion occurs in copper sulphides at temperatures above 400°C at rates of decided interest, and is therefore a possible mechanism in the process of formation of ore deposits, according to J. E. Gill of Canada. The temperature was established by recent experiments carried out in the laboratories of McGill University. Less striking diffusion occurs in FeS, PbS, and ZnS, and possibly in other sulphides.

Exception to the existing theory of metasomatism was taken by Baclav Hanus of Czechoslovakia. The main disagreement lies in the presence of solution cavities or of their filling in metasomatic bodies in soluble rocks.

"Solvate apposition" is the process used by the author to explain the filling of solution cavities in the millimeter-to-meter range. Contrary to former views, hydrothermal metasomatism is not considered as an independent process under natural conditions, but as one of the continuous genetic series of hydrothermal-mineralization processes — as a special case of solution accompanied by filling of open spaces of elementary dimensions.

The metasomatism can easily pass over—when conditions are altered—into filling of pre-existing open spaces, on one hand, and into solution, only partially compensated by the formation of new minerals, on the other hand. The metasomatism is conceived as a product of simultaneous and equilibrium action of two processes (formation of solution cavities and filling of these cavities), the processes being capable of independent action under suitable conditions.

Heavy (ore) metal content of ore-forming fluids was determined by examining fluid inclusions in transparent ore and gangue minerals. Minerals such as quartz, calcite, fluorite and sphalerite furnished data, according to Edwin Roedder of the USA. A major conclusion, among others, was (although there are alternative explanations) that the quantitative evidence supports the concept of the ore-forming fluids' being exceedingly dilute in ore-metal content—in the range of 0.0001 to 0.01 g/l, up to a maximum of perhaps 0.1 g/l.

Russian definitions and explanations of ore deposits related to magmas were given by L. N. Ovchinnikov. Observations on magmatogene deposits of the Urals and special experiments show that:

1. A magma is an ionic-electronic microheterogeneous liquid that contains atoms of iron and other metals in solution. A tendency to exfoliation is inherent in the inner structure of a magma melt, and these metals separate by liquation caused by a change in the melt composition (interactions with limestones, etc.), or by a drop in temperature.

2. The separated ore substance coalesces, and in granitoids it is carried out by gas bubbles, this process being analogous to froth flotation. In the rocks of the cover these bubbles combine into gas jets, and a concentration of the substance takes place with the formation of ore bodies of contact-metasomatic and other types.

3. In basic melts poor in gases, the ore substance precipitates in the mother rocks, forming primary magmatic depos-

its or deposits associated with magmatic metasomatism.

Experiments establish that between the basalt melt and the limestone at their contact an intensive diffusion exchange is taking place with a mobility series of basalt constituents: K> Na> Fe> Mg> Al> Si. There is a possibility of formation of certain types of titanium-magnetite ore bodies in this manner.

4. Components of a solution separated from a source move differentially; and this is controlled by a filtration effect which increases with the radius of the filtrating hydrated ion (a particle in general) and the pressure on the solution, and decreases with the increase of the medium pores, the rise of temperature, and the concentration of the solution and its diffusion coefficient.

A zonal distribution in the deposition of different metals around the source, and their restraint by barriers of various permeability, might be explained by an influence of the filtration effect.

A classification of bauxites by origin was given by H. R. Hose of Canada. The genetic groups are: (1) bauxites formed from igneous, metamorphic, volcanic, and sedimentary rocks on peneplains; (2) bauxites formed on dissected volcanic domes and plateaus; (3) bauxites formed from limestones or karsted plateaus; and (4) sedimentary reworked bauxite deposits. Supporting this classification, details were given of the bauxitization of the rocks, which have formed the commercial bauxite deposits of the world.

The close association between hydrothermal alteration and molybdenite mineralization at the Questa mine, Taos County, New Mexico, was explained by Robert H. Carpenter of USA. Molybdenite mineralization appears to have begun during a period of strong alteration, and continued after hydrothermal activity had largely ceased. Several stages of mineralization are evident.

Texas Gulf May Mine Potash at 12,000 tpd

TEXAS GULF SULPHUR CO. is considering production of up to 12,000 tpd of potash, far in excess of original projections, at its proposed Cane Creek development in southeastern Utah.

C. F. Fogarty, vice president of exploration, made the comments following a visit with state officials in Salt Lake City. Texas Gulf is enlisting aid of Gov. George D. Clyde in petitioning the U.S. Government for immediate withdrawal of lands from oil and gas developments on which it has potash permits.

The company regards simultaneous oil and gas drilling and exploitation inimical to underground mining of potash, because it is dangerous both to miners and the deposit. Fogarty said that Texas Gulf is now studying whether to operate

(*News continues on p 136*)

As We Went to Press . . .

Expenditure of $750,000 has been proposed by Kennecott Copper Corp. for a pilot plant at the Garfield smelter to test oxygen smelting. C. D. Michaelson, general manager of Western Mining Divisions, said use of oxygen lances will be confined to reverbs.

The Salt Lake research center has examined oxygen smelting for some time, and other tests have been run at the Chino smelter. Other copper producers, including Anaconda, are testing.

The AEC will buy 3-million lb of uranium concentrates produced from ores mined in Wyoming's Shirley Basin by Petromics, Inc., a partnership of Kerr-McGee, Tidewater Oil, Skelly Oil and Getty Oil, at the $8 per lb price between March 31, 1962 and Dec. 31, 1966.

Petromics has an option to build a mill, and "in all probability" will build one of about 300 tpd for about $3-million. No special amortization is included in the contract. AEC has the right to direct the ore to other mills.

Meanwhile, a proposal for a 1,000-tpd mill in the Shirley Basin by Hidden Splendor, Federal Resources and Gas Hills Uranium is still pending before the Commission.

Mechanization at an opencast iron ore mine in the Krivoi Rog basin in the Soviet Union will speed output to 140 tons per man in a six-hour shift and exceed U.S. productivity at similar mines, Soviet news agency Tass reports.

Mobile crushers operating in the pit will accelerate further processing of the ore at the 18-million tpy plant to be built.

Freeport Nickel Co.'s $75-million nickel-cobalt mines and plant in Cuba, closed since March because of the government's "drastic new tax legislation," were "intervened" by the Castro regime.

The firm said that it would take all possible steps under Cuban law and under international law to protect its legal rights over the idle project. This island plant was part of a $119-million combine designed to produce nickel-cobalt sulphide concentrate for the company's refinery in the U.S.

Prior to the shutdown, the project was employing about 1,500 Cubans: 900 operating and 600 construction workers. At full production it would provide over 1,000 permanent operating jobs, and was predicted to be one of Cuba's largest taxpayers.

A total of 9,729 short tons of beryl stocks, including beryllium (see p. 93), was announced in the latest public figures. The sum includes (tons): Defense Production Act inventory, 1,985; Supplemental stockpile, 7,034; and Agriculture Department barter stocks, 710. Not listed is the secret national security stockpile.

The sub-Arctic uranium mine at Port Radium, NWT, that helped produce the first atomic bombs, is mined out and will shut down in mid-September.

Eldorado Mining & Refining Ltd. opened the plant in 1930 to mine its radium deposits, selling uranium ore as a by-product. In 1940 the operation shut down but was reopened again in 1942 when the Manhattan Project began.

Three major chemical companies have launched full-scale phosphate prospecting operations on the Elk River in the Veto, Ala., area. The prospectors are: Virginia-Carolina Chemical Co., Armour Chemical, and Victor Chemical.

WASHINGTON IMPACT

Highlights

THIRD SESSION THEME—In its special session last month, Congress applied to nearly every legislative item on its agenda a formula familiar to metal-mineral mining industry representatives on Capitol Hill for years. The overriding objective in the handling of each bill was to make a record that would help pass or defeat it or similar legislation next year, rather than to force a show-down vote in the tense political campaign-year atmosphere in Washington in August.

Mining and other so-called "special interest" legislation often has received this treatment in the past. Last month, Congressional leaders used the same approach to almost all its pending business, including legislation on its "must" list.

For the mining industries, the single exception was Senate approval of Federal subsidies for small lead and zinc mine operators (see story this page). As this issue of EMaJ went to press, the President had not signed the measure into law.

Left for next year, when of course they will have to be introduced from scratch all over again, were: proposed tariff hikes for lead, zinc, fluorspar, and other items whose producers are seeking additional protection against foreign imports; a wide range of Federal subsidies in the form of price supports or production bonuses for a number of metals and minerals; minerals policy legislation aimed at fixing greater responsibility with the Secretary of Interior; and the whole question of stockpile purchases and disposals.

METAL IMPORTS UNDER GATT—Steel and ferrous product makers led off official hearings in Washington last month on U.S. metal-mineral trade policies and negotiations under the International General Agreement on Tariffs and Trade coming up next year (see story this page).

Industry witnesses before the Tariff Commission and Inter-Agency Committee for Reciprocity Information (CRI) set the pattern other metal-mineral producers, processors, and traders followed in subsequent testimony: it boils down to whether the domestic company depends on imported supplies or competes with them, that fixes its stand for or against lowering U.S. import restrictions.

The Administration proposes to offer import concessions on a number of key metals, including iron and steel products, lead and zinc products (though not on the metals themselves), nickel, copper and brass items, and several other nonferrous alloys and forms. Washington is seeking foreign import concessions on nearly every metal-mineral item the U.S. exports, in return.

A NEW U.S.-LATIN AMERICAN POLICY—For metal-mineral industry investors and traders, the long-range significance of Organization of American States emergency meetings on Cuba, communism and the Dominican Republic is the sweeping new economic policy approach Washington is devising to help mend its diplomatic fences south of the border.

Plans now call for more U.S. Government aid to public works projects such as land resettlement and housing, and later for basic industrial development of power and natural resources, including minerals. The new attitude also means lower U.S. import barriers against Latin American exports, virtually killing chances for higher lead-zinc duties, for example.

ALUMINUM PROJECT SNAGGED—Washington foreign-aid officials are trying to patch up international negotiations over a huge proposed hydro-electric power and aluminum development project in the West African state of Ghana. The problem is to find enough low-interest government aid money to help build power plants on Ghana's Volta River so that the Ghana government can reduce the electric power rate it will charge an international consortium of aluminum producers, headed by Kaiser Industries Corp., for its planned smelter. A dispute over the proposed rate last month pointed up the difficulties of this kind of joint international government-private partnership, which Washington considers a cornerstone of its foreign aid program. The outlook is that a $30-million U.S. loan will help get talks back on the track.

Congress Sets Stage For 1961 Metal Bills

LEGISLATIVE BATTLE LINES for next year's debates over U.S. policies affecting the metal-mineral industries sharpened up considerably in the special Congressional session last month, despite the fact that only one mining bill was passed by the 86th Congress (see left).

Basically, the issue of federal support for domestic metal-mineral production comes down to one alternative: if domestic producers get any new benefits it will be in the form of import protection or subsidies such as production bonuses or price supports. Significant tax relief and government stockpiling purchases are beyond any reasonable probability.

Prospects favor the subsidy approach over substantial import relief, although broad subsidies are by no means a sure bet.

The single mining measure both houses of Congress did approve this summer followed the subsidy formula. It calls for Federal payments to small mine operators producing up to 2,000 tpy of lead and zinc, propping domestic prices of the metals at 17c per lb for lead, 14½c for zinc. The bill, sponsored by Sen. Robert Kerr (D.-Okla.) and Rep. Ed. Edmondson (D.-Okla.), squeaked through the House by a 195-192 vote, but passed the Senate by the substantial margin of 58-29.

Before deciding whether to sign the bill, the President was faced with a tough alternative, too. Mining state legislators up for reelection urged his approval in order to have a concrete advantage to take to their constituents. Some White House economists opposed it on ground it would set a precedent for other similar bills next year. In itself, the Kerr-Edmondson Bill was estimated to cost the Government the relatively small sum of $4.8-million a year for five years. But like legislation was introduced this past session applying the same kind of formula to numerous other nonferrous mines, including a bonus-payment measure for beryl, cobalt and columbium-tantalum.

The higher-tariff approach, tried by producers of lead-zinc and fluorspar during this session, will run into several special roadblocks next year. For one thing, the new U.S.-Latin American economic policy Washington is hammering out (see Highlights) means, among other things, a more liberal attitude toward Latin American imports of such items as lead-zinc, copper and other minerals. It was this new program, more than other single factor, that worked against a move by Sen. Kerr and Rep. Howard Baker (R.-Tenn.) to double current lead-zinc import tariffs in place of present import quotas.

However, a sweeping review of overall U.S. tariff policy is in the works for next year's session, and it could mean new basic trade legislation which might provide either more or less import protection. If it provides less, some other form of federal help is likely; one proposal talked about most often on Capitol

Hill would set up Government payments to domestic producers injured by import competition.

Looking ahead, though, pressures will be strong on the next Administration to keep on following an expansionist, rather than protectionist, import policy line.

AMC May Get Clues To 1961 legislation

AMERICAN MINING CONGRESS' annual meeting at Las Vegas next month will provide a significant hint of what Administrative policy toward domestic mining will be like under the new Administration next year, whichever party wins the White House.

On the scheduled agenda of sessions and forums are more than the usual number of Senators, Congressmen, and Government agency officials concerned with mining laws and regulation.

Congolese Complexities Challenge Industry, UN

THE CONGO CRISIS has almost as many complex implications for U.S. diplomatic and foreign economic policies as it has for the Congolese.

As of the end of August, the major copper mining interest in seceded Katanga province, Belgium's Union Miniere, was still producing at normal rates, and U.S. government commodity experts foresaw no immediate world copper market or price disruptions. But as in the political area, officials were keeping their fingers crossed. Katanga copper production runs about 8% of world output. Should a real civil war erupt between Congolese Central Government forces and secessionist chiefs in Katanga and neighboring Kasai, called the "Mining State," Free-World supply and price would be seriously affected.

Longer-range, if UN efforts are successful in avoiding open conflict, the question of foreign money and technicians needed, both to develop other mineral potential in the Congo and to maintain present production remains a knotty one.

U.S. investors and mining interests conceivably could benefit from new opportunities, if a peaceful settlement is achieved in the Congo. But there is also the dangerous threat of a Russian-U.S. showdown in the area.

If Congolese Premier Patrice Lumumba manages to oust the UN completely from the Congo, the U.S. itself is faced with the prospect of having to deal bilaterally with the new nation in an effort to prevent a communist takeover. Even if such a situation turned out favorably to the U.S., Government officials would have the problem of lining up private mining development money and technicians to help put the Congo economy back on the track.

Labor This Month

PRODUCTIVITY ON THE RISE: New bargaining ammunition for the Mine-Mill & Smelter Workers Union is supplied by the newest and most complete figures so far on worker productivity in nonferrous mining. The Labor Department's Bureau of Labor Statistics shows a hefty post-recession advance in production worker output in 1959: crude ore copper mining, an 8.4% climb; recoverable metal copper mining, a 0.9% increase. These figures compare with the over-all output-per-man-hour record for private industry of 4% for the year.

A TWO-EDGED BARGAINING SWORD: Advancing productivity cuts both ways when labor leaders attempt to translate higher worker output into higher wages. While the basis for most pay raises is the increase in productivity, it reflects in part large output with a smaller work force. Take the assertion of AFL-CIO economist Nat Goldfinger on the latest figures: "Much of the increase in productivity in recent years has resulted not in increased production of needed goods and services but rather in increased displacement of the labor force and rising unemployment." When jobs are less plentiful, the union leader's bargaining leverage falls off. The workers he bargains for may be less willing to take risks.

FEDERAL WELFARE FUND LAW—A BUST: This two-year-old law that requires reporting and disclosure of all welfare and pension funds covering 25 or more employees is a "shameful illusion" to Labor Secretary James P. Mitchell, who oversees its workings. Mitchell, in a report on the law's first 18 months, says it has failed to uncover a single instance of embezzlement, fraud, conflict of interest or other violations which it was designed to do. Congress passed the measure in 1958 after extensive hearings uncovered such practices. "Now," says Mitchell, "it would seem illogical to assume that these abuses in their entirety have ceased simply because administrators of covered pensions and welfare plans must publish plan descriptions and a limited amount of financial information. . . ."

Mitchell's chief indictment is his lack of authority to police the law. His department is simply a collection agency, with no powers to compel compliance or prosecute violators. As a result, he says, the law goes unheeded in many cases. A Labor Department survey shows:

1. A total of 142,000 welfare and pension fund reports filed by employers, employees or jointly in the first 18 months. This is at least 50,000 shy of the total reports that should have been filed in this period.
2. Deficiencies were uncovered in 17,000 reports submitted. After the Labor Department asked for corrections, only one-fourth of the fund administrators complied.

A NEW NONFERROUS WAGE STRUCTURE: When officials of Kennecott Copper Co. and Mine-Mill & Smelter Workers Union recently overhauled job classifications for 5,000 workers, they may have set standard wage patterns for the rest of the nonferrous industry. At least Mine-Mill leaders hope so. The union claims that the job evaluation agreement means substantial wage increases for most of the employees, with only a few jobs downgraded. Mine-Mill claims a gain, also, in hiking wages in the Southwest up closer to other regions.

SIGNS OF A NEW LABOR FEDERATION: Prospects are on the rise for a new alliance of labor unions outside the AFL-CIO fold. Leaders of the Teamsters Union, Mine-Mill & Smelter Workers, United Electrical Workers and the International Longshoremen & Warehousemen's Union have huddled together on mutual interests. All have been expelled, at one time or another, from the big labor federation. James Cross's ousted Bakery Workers Union has already talked merger with the Teamsters' James R. Hoffa. Harry Bridges' West Coast Longshoremens' Union now bargains jointly with the IBT on the West Coast docks. Such a team-up, if it comes, would be run by the massive Teamsters Union, the nation's biggest with 1.6-million members. Currently, the AFL-CIO and the expelled unions carry on a low-pitched battle but if a new labor federation is formed, it could bring with it a much more serious labor feud.

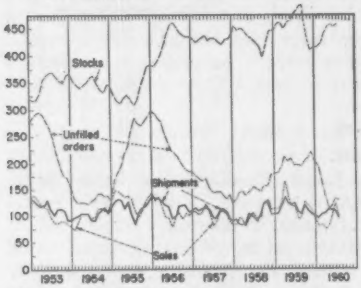
MARKETS

Copper Price Holds; Foreign Sales High; ITC Removes Quotas; N. J. Zinc Struck

NONFERROUS METALS PRICES IN AUGUST were little changed from July or June, according to the E&MJ metal price index. The August figure fell 0.1% to 126.0% of the 1947-49 average on the strength of a decline in the price of tin: from 103.538¢ to 102.940¢ a lb.

In August for the fifth consecutive month price stability was the pattern. Since April there have been no domestic changes in the prices of primary copper, lead, zinc, aluminum and silver.

U.S. Copper Fabricator Data



Data in thousands of short tons from U.S. Copper Assn. The sales and shipment series are related only to purchases of refined copper by the fabricators, including copper refined by custom smelters from their intake of scrap and concentrates. All statistics refer to brass mills, wire mills and foundries. All series are for fabricated products except stocks which are of refined copper and copper in process. July is the last month indicated. Sales and shipment series are two months moving averages.

All sales of copper by producers and custom smelters to domestic buyers during the month were at a 33¢ per lb delivered. Industry crusaders for copper price stability are only partially grateful. Artificial supports in the form of political strife in the Congo and threatened strikes in Rhodesia and Chile counterbalanced disappointingly low demand in the U.S. They see world production outdistancing consumption with resulting downward pressure on world prices.

As we went to press, market men focused on the custom smelter price. The London price of copper dropped £17½ (2.2¢) during the month. As the end of the month approached, smelters were able to cut their buying price by ½¢ to 25½¢ as more scrap was available to them. Dealers, selling at 31⅜¢ to 31⅝¢, were moving metal both in the U.S. and abroad. Buyers who felt the market was basically weak and who were holding off for a custom smelter price break became interested in bargain metal.

Influences helping to resist a price cut were the turbulent Congo, good buying abroad, possibility of a strike on Sept. 30 at Anaconda's Chuquicamata plant in Chile and the smelter inventory position.

Katanga Province, in which 9% of the world's copper is produced, is attempting to secede. The UN has taken a policy of non-interference in Congo internal affairs. The possibility of civil war clouds the copper market. Meanwhile Katanga shipments have been moving normally via overland detours.

The Chamber of Mines and the African Mineworkers Union reached labor agreement toward the end of the month. Labor peace has been assured in Northern Rhodesia for at least 17 months. But the situation at Chuquicamata is more hectic. Copper workers, among the best paid workers in the country, have made exorbitant demands, early reports say. There has been no word of progress. Chuquicamata produces about 25,000 tons of copper per month.

Smelters, who must move their intake of scrap and ore, have not built up large inventories owing to the good demand for scrap outside the U.S. They are reluctant to sell copper at cutrate price when it has been made from high-cost scrap. An improved export business has helped alleviate pressure.

Factors mentioned above have combined to create a sort of neutrality in the copper market. Should London continue off, prospects for a smelter price cut by mid-September are good.

The tonnage of copper sold outside of the U.S. reported to E&MJ was the highest on record. Flat price domestic sales were about 50% of the foreign figure and extremely low. They were slightly better than July.

U.S. consumption of fabricated copper in July was the lowest since the 1949 recession. New business was also poor, dropping 57,000 tons below June. Stocks of copper in the hands of fabricators rose 8,000 tons.

Stocks of world refined copper rose 31,000 tons in July, but the U.S. share was only 4,000 tons. Refined production here was down 31,000 tons from the June record. U.S. stocks, though up, were not considered high. World deliveries slumped.

The International Tin Council surprised the world when it announced late in the month that it had removed export quotas for the fourth quarter 1960. Producing countries will now be free to operate as they please in the world market with only the support prices of £780 at the bottom and £830 at the top as a guide. Below £780, the Pool manager would be expected to buy tin to tighten the market; above £830, he would sell to supplement the world's supply.

Observers see the cancellation as a substitute for reallocation of quotas. Many of the smaller producing countries have been unable to fulfill their requirements under most recent restrictions. As a result world stocks have been cut. Countries—particularly Malaya—capable of producing more and using up limited stocks of metal and ore will not be held back. Some feel ITC action was abetted by heavy first half U.S. consumption figures. Buyers here bought heavily following the extended U.S. steel strike. Business in the second half has fallen off sharply. Unless the tinplate business here picks up, reimposition of quotas in the first half of 1961 is in prospect.

Aluminum producers raised prices of a great many alloyed ingot and mill prices commencing August 1. Companies have dropped the old "pig" designation for that of "unalloyed ingot." Recently there has been no chemical difference in pig and ingot; all unalloyed ingot is 99.5% pure. E&MJ has eliminated the pig label and the old ingot quotation of 28.1¢. Premiums are charged for high-purity alloyed ingot. Price hoists came concurrently with industry wage and fringe benefit increases contracted for August 1.

The basic ingot price of 26¢ held firm. Primary stocks at the end of June jumped 21,000 tons and shipments fell 8,500 tons. Primary production in July moved up 6,000 tons to 177,500 tons, only slightly below the alltime high. During July the industry operated at 85.8% of capacity. The figure is expected to be down in August. Kaiser shut down one of its nine potlines at Chalmette, La. The company is now at 78% of capacity.

The Department of Commerce, preparing for January GATT meetings, was told by the industry that the U.S. should seek reductions in tariff rates of GATT members for both primary aluminum and semi-fabricated products to prevailing U.S. rates.

The price of mill producer's rigid conduit has been cut 5% following a cut in the galvanized product. The price had been raised the same amount on Aug. 1.

July zinc stocks turned up 20,000 tons heavier than in June and might have been a source of real weakness had it not been for a walkout of workers at N.J. Zinc Co.'s smelters at Palmerton, Pa. and Depue, Ill. About 10,000 tons capacity per month is being lost. Bunker Hill (6,000 tons per month) remained struck during August.

Zinc sales reported to E&MJ with a sudden surge the last week of the month pulled slightly ahead of July. Prime Western has lagged with the steel slump (54% of capacity), but good call from die casters kept SHG moving. The 13¢ price was steady to firm.

A subsidy bill for small producers of lead and zinc was passed by both houses of Congress, but was vetoed by the President. The Kerr lead-zinc tariff bill did not come to a Senate vote. A renewed price-support drive is expected.

August lead sales were fair—slightly ahead of July—but at press time sellers were disappointed in fall orders. The price of 12¢ N.Y. was steady. Stocks increased 6,000 tons in July. Shipments dipped to the yearly low—normal for July.

Houston Chemical Corp. has joined Ethyl Corp. and Du Pont as a producer of tetraethyl and tetramethyl lead, gasoline additives.

Average Prices August (E&MJ Quotations)

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	32.600
Electrolytic, exports refinery	29.925
Electrolytic, c.i.f. Cont'l ports	30.870
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver:	
Silver, New York, per oz	91.375
Silver, London, pence per oz	79.250d
Zinc:	
Prime, Western, East St. Louis	13.000
Prime, Western, delivered (g)	13.500
Tin:	
New York Straits	102.940
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	281.024
Quicksilver, per flask	$209.000
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for. 99%	22.875(h)
Palladium, troy oz	$24.000
Platinum, refined, per oz	82.000
Cadmium (a)	140.000
Cadmium (b)	150.000
Al, 99½% unalloyed ingot	26.000
export, ingot	23.250
Magnesium, ingot	35.250
Nickel, (f)	74.000
Bismuth	$2.250
Cobalt	$1.500

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) No duty extra.

Free Gold Market

Volume of world gold dealings increased 53% during August to the highest level in over a year, as gold prices rose everywhere. Bar prices in London listed at $35.165, a new record since the reopening of the market in 1954. Gold futures were in more active demand with transactions averaging about $750 thousand daily. Carrying charges in London rose to 6% p.a., and 4¾% p.a. in Swiss centers. U.S. gold losses once again continued, as the stock dwindled to a new low of $19.006-billion. Pick's World Currency Report quotes on "free gold" per fine oz. as follows:

	Coins		Bars (12.5 kg)	
	July 30	Aug. 31	July 30	Aug. 31
New York transit	.....	.....	$35.08½	$35.08½
Manila	$40.00	$40.25	35.80	36.00
Hong Kong	48.40	47.50	38.90	39.25
Bombay	52.50	53.25	52.00	53.00
Beirut	39.25	39.65	35.26	35.33
Paris	39.75	39.90	36.10	36.05
Buenos Aires	39.10	39.25	37.80	35.75

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper

Based on flat price and E&MJ average price sales in U.S. for month of July reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ¼c; ¼c deducted for selling common.

Delivered consumer's plant	32.750 lb
F. o. b. refinery	32.350 lb

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Aug. 1960	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (e)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Ingot 99½% U. S. Dest.	Straits Tin New York
1	32.600	No Quote	No Quote	12.000	11.800	13.500	13.000	26.000	104.625
2	32.600	30.725	31.670	12.000	11.800	13.500	13.000	26.000	104.625
3	32.600	30.875	31.820	12.000	11.800	13.500	13.000	26.000	104.500
4	32.600	30.675	31.620	12.000	11.800	13.500	13.000	26.000	104.375
5	32.600	30.525	31.470	12.000	11.800	13.500	13.000	26.000	104.250
8	32.600	30.500	31.445	12.000	11.800	13.500	13.000	26.000	103.750
9	32.600	30.525	31.470	12.000	11.800	13.500	13.000	26.000	103.750
10	32.600	30.450	31.395	12.000	11.800	13.500	13.000	26.000	103.750
11	32.600	30.100	31.045	12.000	11.800	13.500	13.000	26.000	103.500
12	32.600	29.950	30.895	12.000	11.800	13.500	13.000	26.000	103.250
15	32.600	29.675	30.620	12.000	11.800	13.500	13.000	26.000	102.625
16	32.600	29.500	30.445	12.000	11.800	13.500	13.000	26.000	101.875
17	32.600	29.525	30.470	12.000	11.800	13.500	13.000	26.000	102.125
18	32.600	29.825	30.770	12.000	11.800	13.500	13.000	26.000	101.875
19	32.600	29.925	30.870	12.000	11.800	13.500	13.000	26.000	101.625
22	32.600	29.675	30.620	12.000	11.800	13.500	13.000	26.000	101.625
23	32.600	29.650	30.595	12.000	11.800	13.500	13.000	26.000	102.125
24	32.600	29.800	30.745	12.000	11.800	13.500	13.000	26.000	102.500
25	32.600	29.550	30.495	12.000	11.800	13.500	13.000	26.000	102.375
26	32.600	29.525	30.470	12.000	11.800	13.500	13.000	26.000	101.875
29	32.600	29.200	30.145	12.000	11.800	13.500	13.000	26.000	102.250
30	32.600	29.175	30.120	12.000	11.800	13.500	13.000	26.000	102.250
31	32.600	29.000	29.945	12.000	11.800	13.500	13.000	26.000	102.125
AVERAGES FOR MONTH									
Aug.	32.600	29.925	30.780	12.000	11.800	13.500	13.000	26.000	102.940
AVERAGES FOR WEEK									
Aug.									
3	32.600	30.756	31.701	12.000	11.800	13.500	13.000	26.000	104.600
10	32.600	30.535	31.480	12.000	11.800	13.500	13.000	26.000	103.975
17	32.600	29.750	30.695	12.000	11.800	13.500	13.000	26.000	102.675
24	32.600	29.775	30.720	12.000	11.800	13.500	13.000	26.000	101.950
31	32.600	29.290	30.235	12.000	11.800	13.500	13.000	26.000	102.175
CALENDAR WEEK AVERAGES									
Aug.									
5	32.600	30.700	31.645	12.000	11.800	13.500	13.000	26.000	104.475
12	32.600	30.305	31.250	12.000	11.800	13.500	13.000	26.000	103.600
19	32.600	29.690	30.635	12.000	11.800	13.500	13.000	26.000	102.025
26	32.600	29.640	30.585	12.000	11.800	13.500	13.000	26.000	102.100

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U.S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(e) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots: cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western: Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Aug. 1960	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	Holiday	280.8940	Holiday
2	91.375	79.250d.	280.9000	250s. 2¼d.
3	91.375	79.250d.	280.7560	250s. 2¼d.
4	91.375	79.250d.	280.8700	250s. 1¾d.
5	91.375	79.250d.	280.8580	250s. ¾d.
8	91.375	79.250d.	280.9000	250s. ¾d.
9	91.375	79.250d.	280.9520	249s. 11¾d.
10	91.375	79.250d.	281.0380	249s. 11½d.
11	91.375	79.250d.	281.0500	249s. 11½d.
12	91.375	79.250d.	281.1600	249s. 10¾d.
15	91.375	79.250d.	281.1580	249s. 9¾d.
16	91.375	79.250d.	281.0740	249s. 10d.
17	91.375	79.250d.	281.0620	249s. 11¼d.
18	91.375	79.250d.	281.1440	249s. 11¼d.
19	91.375	79.250d.	281.0960	249s. 11¼d.
22	91.375	79.250d.	281.0580	249s. 11¼d.
23	91.375	79.250d.	280.9420	250s. 1¼d.
24	91.375	79.250d.	280.9840	250s. 2½d.
25	91.375	79.250d.	281.1220	250s. 2d.
26	91.375	79.250d.	281.0860	250s. 1¾d.
29	91.375	79.250d.	281.1080	250s. 1¾d.
30	91.375	79.250d.	281.0960	250s. 1¾d.
31	91.375	79.250d.	281.1450	250s. 2d.
AVERAGES FOR MONTH				
Aug.	91.375	79.250d.	281.024	—
AVERAGES FOR WEEK				
Aug.				
3	91.375	—	280.870	—
10	91.375	—	280.924	—
17	91.375	—	281.101	—
24	91.375	—	281.045	—
31	91.375	—	281.111	—

Calendar Week Averages: New York Silver: Aug. 5, 91.375; Aug. 12, 91.375; Aug. 19, 91.375; Aug. 26, 91.375.

MARKETS *(Continued)*

London Metal Exchange Quotations

Aug. 1960	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1								Holiday								
2	253	253½	248¾	248¾	71¼	71½	71¼	71½	88¼	88⅝	88	88¼	812½	814	814	815
3	253½	253¾	248¾	248⅞	71⅜	71¾	71⅝	71⅞	89	89⅛	88⅝	88⅝	813	814	813½	814
4	251½	252	248	248¼	70⅞	71	71⅛	71⅝	89⅛	89⅝	89	89¼	812	813	813	813½
5	249⅝	250	246¾	247⅛	70½	70⅝	71	71¼	89½	89⅞	88⅝	88⅞	808	809	810½	811
8	250¼	250½	247	247½	70⅝	70⅞	71	71½	89	89⅛	88⅝	88⅞	803½	804	804½	805
9	250¼	250½	247¼	247½	70	70½	70⅜	70⅝	88¾	88⅝	88¾	88⅝	806	806½	807	807½
10	248¾	249	246¾	246⅞	70¼	70½	71	71⅛	88⅝	89	88½	88⅝	806½	807	807½	808
11	245	245¼	244⅝	245	70	70⅛	70⅜	71	88⅜	88½	88½	88⅝	803½	804	805¼	806
12	245	245¼	244½	244⅝	70	70⅛	71	71⅛	88	88⅛	88⅜	88½	802	803	804	804½
15	241¾	242	242¼	242½	69⅝	70	70⅜	71	86¾	87	87¾	88	796¼	797	798	799
16	242	242¼	241½	242	71¼	71¼	71½	71⅝	87½	87½	88	88¼	796	796½	798	798½
17	243½	243¾	243	243¼	71⅜	71⅝	71½	71⅝	87	87¼	87⅝	87⅝	793	794	797	798
18	245½	245⅝	244	244¼	71½	71¾	71¾	72	87⅝	87½	87⅝	87½	793½	794	797	798
19	247¾	247½	245½	245¾	71¾	72	72	72½	87¼	87⅝	87½	87½	791	791½	794	794½
22	242	242¼	241¼	241½	71⅛	71½	71½	71¾	86½	86⅝	86⅝	86½	793	793½	795½	796
23	243⅝	244	242½	243	71½	71⅝	71⅝	71⅞	86	86¼	86	86¼	800	802	804	805
24	242½	242¾	241½	241¾	70¾	71	71	71½	85⅝	85¾	85½	85¾	800	801	802½	803½
25	241¾	242	241	241½	70⅝	70¾	71	71¼	85½	85⅝	85⅝	85⅝	802½	803	804	805
26	241¾	241½	241¼	241½	70½	71	71⅛	71½	86	86⅛	86	86½	794	796	797	798
29	239	239½	239⅜	240	71¼	71⅝	71½	71⅝	86¼	86¼	86⅛	86½	801	802	802	803
30	238	238¼	238¼	238½	71¼	71⅝	71½	71⅝	85¾	86	86¼	86½	799½	800	800½	801
31	235½	235¾	236	236¼	71⅝	71½	71½	71⅝	86	86¼	86½	86¾	799	800	800	801
Av'g's	£245.159		£243.727		£70.949		£71.352		£87.429		£87.460		£801.614		£803.511	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.9%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

MISCELLANEOUS METALS

Aug.'31, 1960

Aluminum ingot, 99.9% lb		28c
Antimony, spot, lb, less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported, 10 ton min. (p), 99% Duty not paid	22¾c —	23c
Bismuth, ton lots, lb		$2.25
Cadmium, ton lots delivered, lb		$1.40
small lots		$1.50
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb, contract delivered		$1.29
Cobalt, 97% to 99%, per lb effective 3-1-60		$1.50
Germanium, per gram, 10,000 gram lots	(d)$28.15c—(c)(d)	$29.95c
Indium, troy oz	$1.35 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35¼c
Palladium, troy oz	$24 —	$26
Platinum, troy oz	$81 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$209 —	$211
Selenium, 99 plus %, lb—(Feb. 19, 1958)	$6.50 —	$7
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$3.50
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U. S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu; spot	$31.75 —	$32.50
term contracts	$34 —	$34.50
Chrome ore per long ton, f.o.b. cars Atlantic ports, dry:		
44% Cr_2O_3 no ratio	(a)$19.75 —	$20.50
48% Cr_2O_3 3 to 1 ratio	$35¾ —	$38
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.70(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$141.72
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal.		
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$20 —	$20.25
U. S. scheelite, f.o.b. mill	$24 —	$25
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton		$80

(a) Nominal. (b) c.i.f. U. S. ports.
(e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4–5c
Cobalt oxide, 72½% to 73½%, per lb, effective Mar. 1, 1960	$1.13 —	$1.18
Copper sulphate, 100 lb. effective Nov. 6, '59		$13.00
Germanium dioxide, gm		16¾c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4.9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo. lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max. 1½% C, lb contracts		11.6c
Spiegeleisen, per lt, 19—21% grade effective Jan. 22	$100.00 —	$102.50

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:

Crude No. 1	$1,400–$1,725	Paper Stock	$120–$142
Crude No. 2	$750–$1,100	Waste	$75– $86
Spinning Fibers	$350– $565	Shorts	$22– $75
Shingle fibers	$180– $220		

Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):

Crude No. 1	$1,522	Spinning fibers	$220–$787

Asbestos, Vermont, f.o.b. Morrisville:

Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218		
Paper stock	$120– $142	Refuse or shorts	$41– $75

Barytes, f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Domestic, crude, 50%, 8% Fe, 13% Si	(c)$12.25 —	$13.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, 60% Al_2O_3, 6% SiO_2, 1.25% Fe, 1–1–60		$7.25
Feldspar, bulk ton; f.o.b. plants:		
Potash or soda feldspar, 200 mesh, ceramic grade	$17 —	$20.50
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1¼x2 in. 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00;"4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton, Bulk sales, dry ground; $30—$55 per ton. Scrap $20—$30.

Ocher, Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, Mexican, for use in Mexico, metric ton, f.o.b. mines, depending on location	$21 —	$23
For export f.o.b. vessel, depending on grade	$20.50 —	$22

Actual prices received by U. S. producers approximate the Mexican export prices.

Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.06
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

B.F.Goodrich

B.F.Goodrich tires haul 50 tons of coal over limestone roads

CENTRAL OHIO COAL COMPANY owns and operates the Muskingum strip mine in southeastern Ohio. Monthly production averages 200,000 tons of coal, carried from mine to dump by giant haulers. The one above carries 50 tons on the 8-mile trip over roads topped with crushed limestone.

There's a job for the toughest tires available — B.F.Goodrich Rock Service tires. They're built with either the new BFG Cut Protected compound (defies rock cuts and snags), the Heat Resistant compound (resists heat build-up) or the Regular compound. And the B.F.Goodrich FLEX-RITE NYLON cord body withstands double the impact of ordinary materials. It resists such tire-killers as heat blow-outs and flex breaks. Result: more retreadable Rock Service tires and more retreads per tire!

Take a tip from successful mine operators — call your B.F.Goodrich Smileage dealer today. He is listed under Tires in the Yellow Pages of your phone book. He has a complete line of money-saving B.F.Goodrich tires for every type of mine work. *The B.F.Goodrich Company, Akron 18, O.*

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

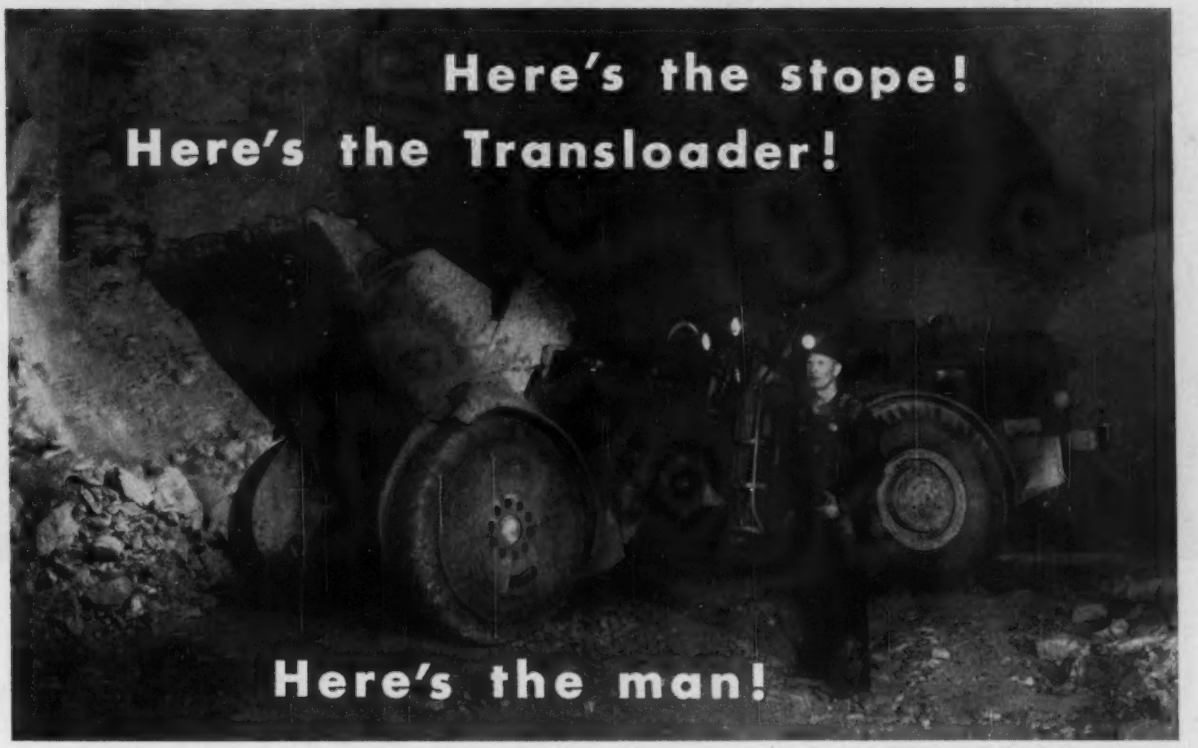
B.F.Goodrich *off-the-road tires*

It is difficult to believe—but the truth is...

This S-D TRANSLOADER LOADED, HAULED and DUMPED 1,045 TONS in one shift!

THIS WAS NO TEST nor demonstration. This customer and user was backstoping. Several thousand tons had been shot. S-D Transloader operator Robert White was simply loading, hauling, and dumping as usual with his self-loading transport. The one way tram to dump hole was 150 feet. (S-D Transloader also operates more effectively and more efficiently than conventional equipment on long hauls.)

AT THE END OF THE SHIFT MR. WHITE HAD MOVED 1,045 TONS OF HARD ROCK! That was 190 loads! On the following night shift he loaded 180 times for 990 tons. He moved 2,035 tons in two consecutive night shifts!



THE FACTS ARE, FURTHER, that the S-D Transloader requires (1) the *lowest* original cost for tons handled . . . (2) *lowest* maintenance, due principally to extremely simple design . . . (3) *least* ventilation due to low horsepower to work done . . . and (4) *lowest* labor cost per ton!

The performances of many S-D Transloaders in several mines justify *your immediate* investigation! The Transloader is doing a job you cannot afford to overlook! Call us — today . . . 3-4191. Wire or write:
Sanford-Day Iron Works, Inc., Dale Avenue, Knoxville, Tennessee, U.S.A.

WE WILL BE AT LAS VEGAS . . . with the S-D Transloader! At our Sanford-Day BOOTH 43, in addition to the Transloader, you will be able to view documentary movies showing exactly what the Transloader is doing *in action* underground to increase production at tremendous reduction in cost! We invite you to visit with us at BOOTH "43" . . . American Mining Congress, MINING SHOW, Las Vegas, Nevada, Monday-through-Thursday, October 10-13, 1960.

SANFORD-DAY
KNOXVILLE, TENNESSEE

966 TRAXCAVATOR—2¾ CU. YD. STANDARD BUCKET • 140 HP Cat D333 Diesel Engine, turbocharged to give extra efficiency and quick response for machine drive and bucket hydraulics. • 57" reach at 7' dumping height . . . maximum lift—12' 10". • LIVE ACTION hydraulics for tough excavation, fast lift and dump. • DUAL-RATIO steering for work and highway travel. Operator shifts lever on steering column to select work or travel ratio. For work cycles and quick turns, one-half twirl of steering wheel puts Traxcavator in maximum turn. For travel ratio, 2 twists of wheel are required for sharpest turn. • DIRECT ELECTRIC STARTING standard. Gasoline starting engine optional.

CATERPILLAR ADDS 2¾ yd. and 1¼ yd. MACHINES

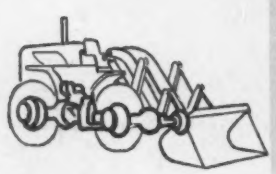
THE 966 and 922

Cat's first wheel loader, the 2 yd. 944, introduced this spring, has already gained an acceptance unmatched in machinery history. Now there's a full line and one for your job: the 966, 2¾ yd., 140 HP, for high production jobs where you measure time in tons of material loaded; the new 922, an 80 HP, 1¼ yd. Traxcavator with all the safety and fast operating features of the two bigger machines. The 922 can give you speed, versatility and production to handle all those jump-and-run jobs.

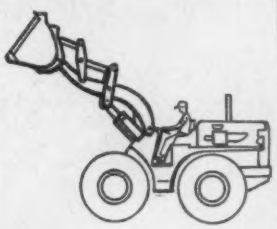
Have you seen a 944 working in your area? Have you asked the owner about its dependability and favorite features? He's probably got some mighty impressive answers. And frankly it's understandable why these Traxcavators have made a name for themselves so quickly. There is a *7-year* history of thorough testing and development behind these *new* machines. They come from the manufacturer with 23 years' loader experience and 20 years of wheel tractor know-how.

Look at the features that are on all 3 loaders: clean, open cockpit, easy to get into; bucket arms up front away from the operator; well-balanced design; long dumping reach (nearly 5' on the 966), soaring lifts to get over truck sides

Both the 966 and the 922 have all the features proved in the field by the popular 944 Traxcavator

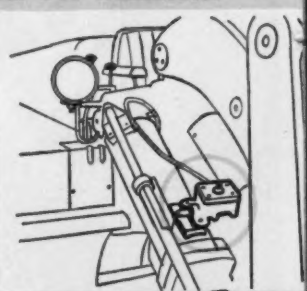


POWER SHIFT TRANSMISSION with torque converter gives smooth, instant shifting for 1st-2nd speeds—forward and reverse. In travel range, the machine is in 2-wheel drive for high-speed roading. A shift to work range automatically puts power to all 4 wheels for full traction.



OPERATOR SAFETY Lift arms and cylinders are all forward of the cockpit . . . giving complete freedom of movement. Visibility is excellent at all times. It's easy and safe to get into a Traxcavator from either side . . . up 3 wide steps . . . no ladders to climb. Tires are covered by fenders.

OPERATOR CONVENIENCE Bucket controls are on the right side, leaving the left hand free for machine operation. The forward-reverse lever is mounted on the steering column for finger-tip shifting without decelerating, steering is power boosted with dual-ratio on the 966.



AUTOMATIC BUCKET KICK-OUT DEVICE allows faster cycles. After loading bucket, pull lift lever to up position. Bucket goes up to dumping height and control kicks into hold position automatically. While lowering bucket after dumping, set tilt lever, and bucket is positioned for digging.

922 TRAXCAVATOR—1¼ CU. YD. STANDARD BUCKET • 80 HP. Your choice of compact 4-cylinder Caterpillar turbocharged Diesel Engine (uses low-cost furnace oil without fouling) or 6-cylinder gas engine with large cubic inch displacement for long life and sustained power. Use the type of engine that matches your other equipment. With either engine you have one source of warranty responsibility . . . one source of parts and service . . . your reliable Caterpillar Dealer. • Long 40¾" reach at 7' dumping height . . . maximum lift of 11' 2". • For top production in its class, the new 922 Traxcavator has all the safe, fast operating features of the bigger machines.

TO ITS WHEEL LOADER LINE...

TRAXCAVATORS

and railroad cars; automatic bucket controls to speed cycles; dependable Cat Diesel power with optional gasoline engines on two smaller models; Cat power shift transmission to change speed and direction with a finger touch, without decelerating; and service features like the dry-type air cleaner and unitized construction.

There's one man in your area with all the facts — your Caterpillar Dealer. Get in touch with him now. Ask for a demonstration — once you watch one of these machines you'll want it!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U. S. A.

CATERPILLAR

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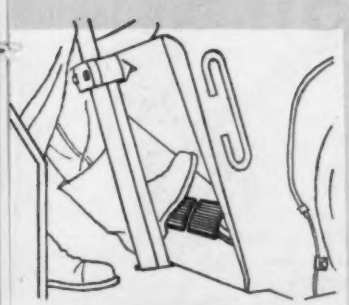
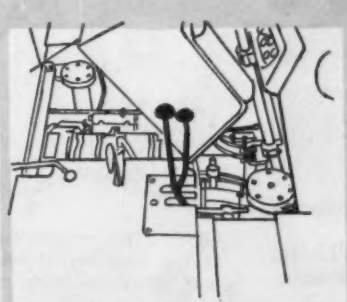
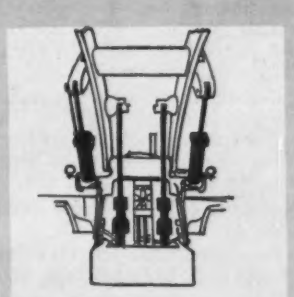
TRAXCAVATORS ARE MAKING OTHER LOADERS OBSOLETE



DUAL BRAKES The left brake pedal neutralizes the transmission as it stops the machine. This transfers extra power to the bucket . . . assuring full loads even in tough material. The right brake pedal stops the machine with the transmission engaged . . . giving full control for roading downhill.



EASY SERVICE ACCESS The seat tips forward for quick access to transmission oil filter and control linkage adjustments. Unit construction allows independent removal of engine, transmission, other major components. The dry-type air cleaner can be serviced in about 5 minutes.



LIVE-ACTION HYDRAULIC SYSTEM Plenty of power from the engine is always available to the husky vane-type pump that supplies the pressure and volume for fast bucket action. Control valves are enclosed in the steel reservoir for complete protection. System is full-flow filtered.

AVAILABLE WITH A COMPLETE LINE OF ATTACHMENTS, including special buckets for light or heavy materials, lift forks for lumber and palletized materials, and the exclusive side dump bucket. A fiber-glass cab is also available.

STAY OUT OF THE MUCK

NOW—Dust-free drilling without water!

...with the Le Roi LLV Dust-collecting Air Leg Drill

You'll drill fast, dry, and clean through the hardest rock with the new Le Roi LLV Dust-collecting Air Leg Drill. It outperforms wet-drilling machines and has a much lower dust count — you don't use a drop of water in the mine or tunnel.

The LLV's efficient dust collection keeps holes clean for faster, deeper penetration — prevents stuck steels and lost holes. Its powerful suction removes cuttings through the hollow drill steel and out the side of the chuck housing. *None* passes through the machine. Results: less maintenance and longer tool life.

What's more, dry cuttings permit continuous ore sampling — and all can be reclaimed!

Ask your Le Roi distributor for a demonstration. Or write Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

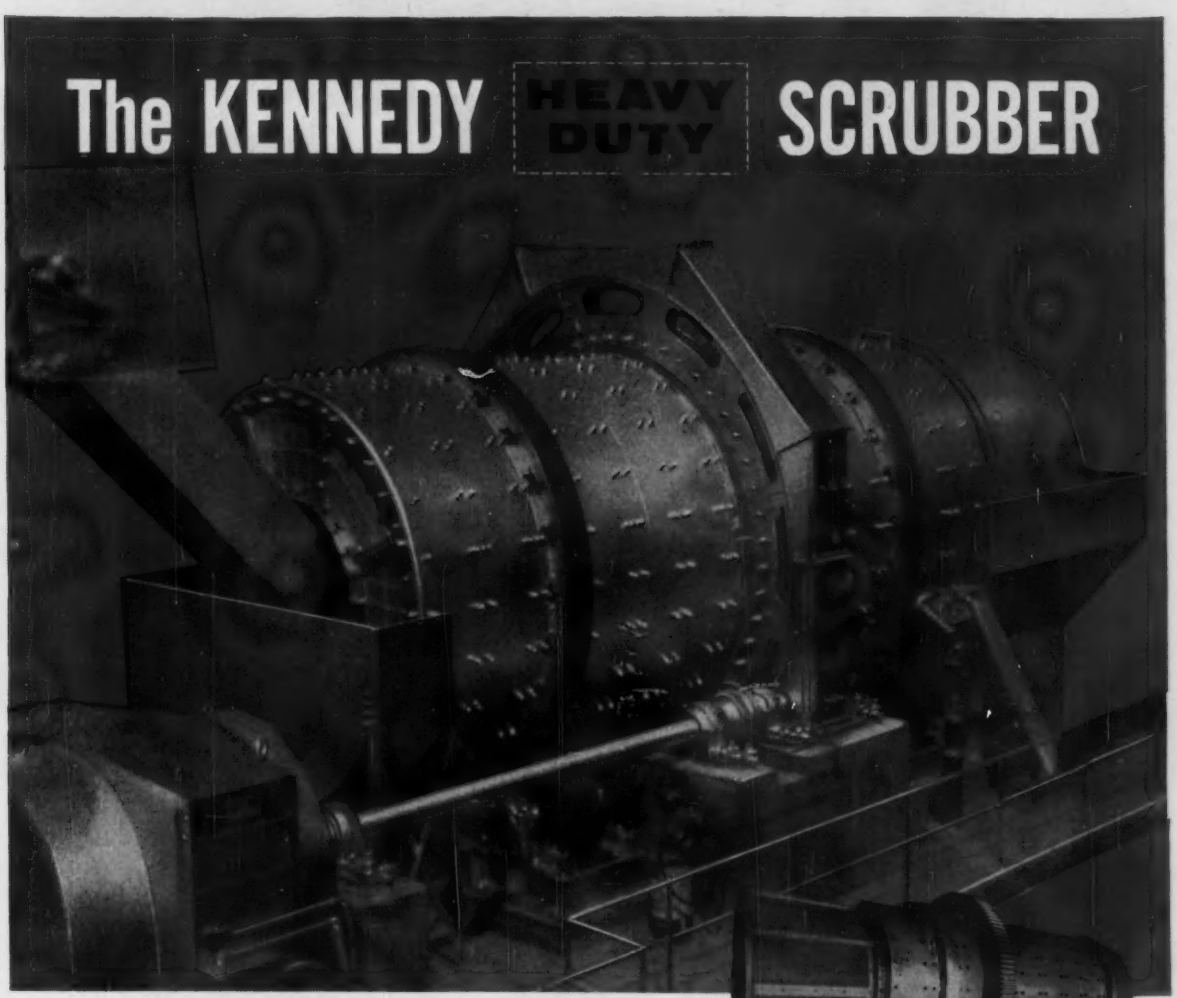
DRY "DUSTLESS" LLV collects cuttings in LX-1 dust box. Operator can empty box by remote control lever on drill.

LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

A Cleaner Product Is A More Saleable Product

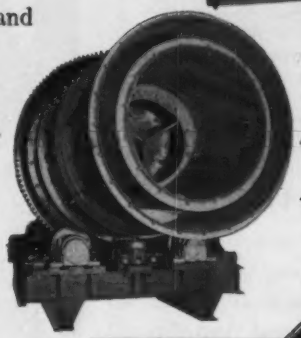
The KENNEDY HEAVY DUTY SCRUBBER



With thoroughly cleaned rock or ore secondary and tertiary crushing and screening operations become more efficient. Control is improved and products are of higher quality. Downtime for blocked crushers or blinded screens is eliminated.

The KENNEDY Heavy Duty Scrubber is outstanding because of these features:

- All welded steel shell
- Wear resistant, replaceable liners
- Replaceable cast alloy lifters for advancing material
- Spherical roller bearings
- Cut gear and pinion
- Enclosed gear reducer drive
- Extra heavy structural steel base
- Counter flow of material and wash water
- Single, double or multiple trommel for dewatering and sizing



▲ *View showing rotary kiln type carrying stations with spherical roller bearing pillow blocks and extra heavy base.*

◆ *Discharge end of scrubber with double trommel. Dirt and clay wash through outer trommel; sized material discharges off end. Oversize discharges off end of inner trommel.*

Let us help you adapt this scrubber to your process.

KENNEDY VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.
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DODGE HAS MORE PROVED BEARINGS THAN YOU HAVE BEARING PROBLEMS!

It pays to buy from a line of stock bearings—bearings that have been proved in thousands of installations similar to yours. You benefit by getting known dependability; and you get the important savings of high quality at production price.

PIN-POINT SELECTIVITY

Dodge has supplied mounted bearings to industry for over three-quarters of a century. Dodge bearings have always kept pace with improved production practices. Each new condition of service has been met by Dodge as it has arisen, with the result that the Dodge line contains mounted bearings to meet almost every service requirement with pin-point accuracy.

High load, high speed, excessive dust, moisture, corrosion, high or low temperatures, continuous operation—you name it!—such conditions and their combinations are met every day with Dodge bearings.

BROAD LINE—WIDELY DISTRIBUTED

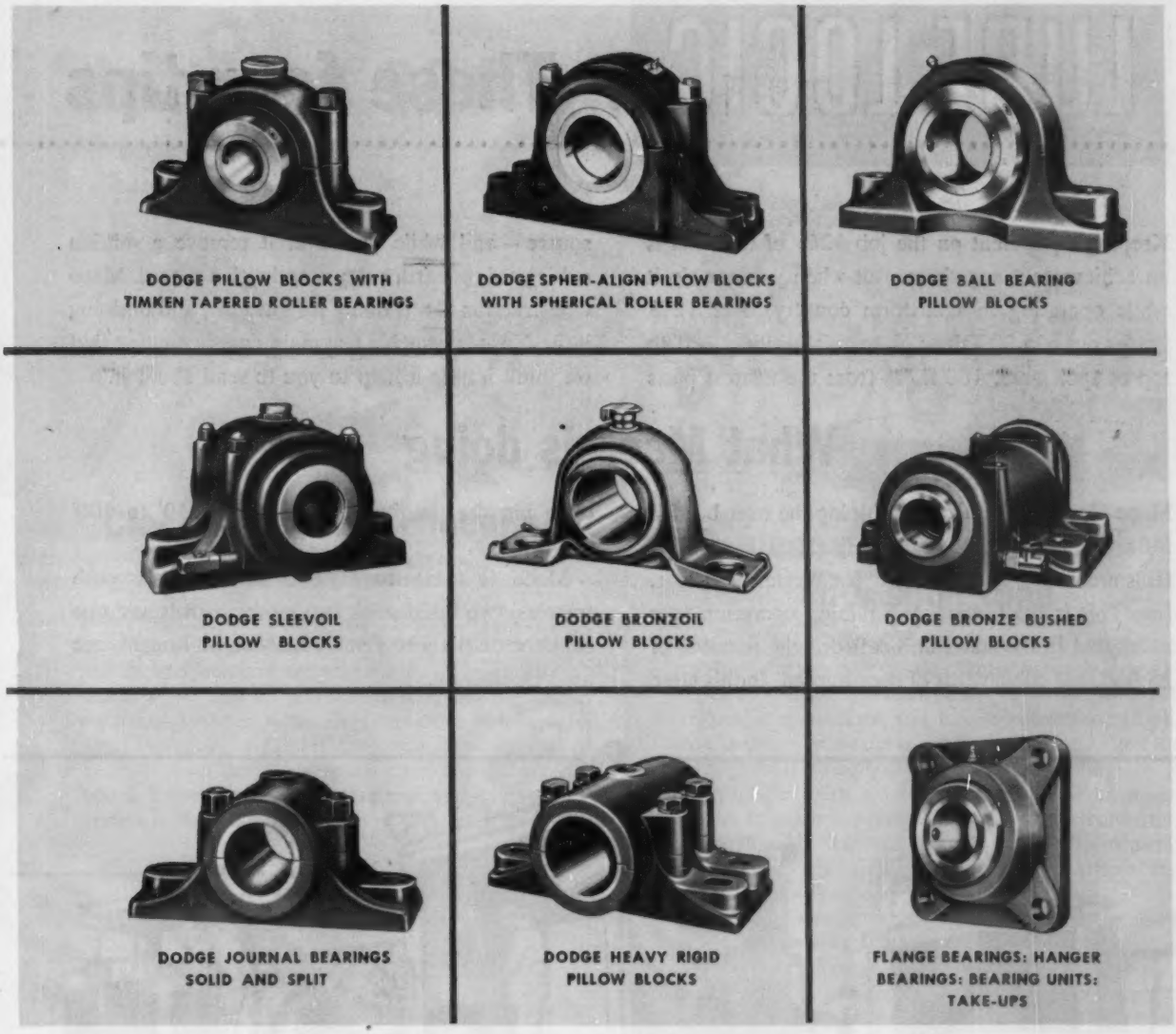
In the great variety of mounted bearings developed by Dodge, you will most likely find the precise unit to fit your requirements ideally—without paying for features you do not need. And if your requirements call for several types of bearings, there is an advantage in having them of common design, such as Dodge offers.

The Dodge line is probably broader than any other line of mounted bearings in America. And of special importance to machinery manufacturers, it is the most widely distributed line. There is always a Dodge bearing of the right type and size near at hand.

You can check this with your local Dodge Distributor. Ask him—or write us for the Dodge Bearing Bulletin.

In addition to tapered roller, spherical roller and ball bearings, Dodge builds many types of sleeve bearings. Here is the "large and small" of the sleeve type bearings carried in stock—ranging from an 8-in. Sleevoil weighing over 1200 lbs. to a ½-in. solid journal bearing weighing 9 ounces.

DODGE MANUFACTURING CORPORATION, 3100 Union Street, Mishawaka, Indiana


DODGE PILLOW BLOCKS WITH TIMKEN TAPERED ROLLER BEARINGS
DODGE SPHER-ALIGN PILLOW BLOCKS WITH SPHERICAL ROLLER BEARINGS
DODGE BALL BEARING PILLOW BLOCKS
DODGE SLEEVOIL PILLOW BLOCKS
DODGE BRONZOIL PILLOW BLOCKS
DODGE BRONZE BUSHED PILLOW BLOCKS
DODGE JOURNAL BEARINGS SOLID AND SPLIT
DODGE HEAVY RIGID PILLOW BLOCKS
FLANGE BEARINGS: HANGER BEARINGS: BEARING UNITS: TAKE-UPS

● **Dodge Pillow Blocks with Timken Tapered Roller Bearings.** America's quality pillow blocks. Assembled, lubricated, adjusted and sealed at the factory. 5 types for varying needs.

● **Dodge Spher-Align with Spherical Roller Bearings.** Rugged heavy duty, compact, inherently self-aligning. Exclusive Micro-Mount simplifies installation.

● **Dodge Ball Bearing Pillow Blocks.** Deep groove ball bearings with long inner races—high capacity. SL, SC and SCM models for light, normal and medium service respectively.

● **Dodge Sleevoil Pillow Blocks.** Ultra quality . . . extra long life . . . accessibility . . . *quiet*. Plain or water-cooled.

● **Dodge Bronzoil Pillow Blocks.** Efficient, low cost pillow blocks with self-oiling, capillary bronze bushings. Self-aligning. Large oil reservoirs.

● **Dodge Bronze Bushed Pillow Blocks.** Quiet fan and blower pillow blocks with two bronze bushings of high lead content mounted in one cast iron housing.

● **Dodge Journal Bearings — Solid and Split.** True running, dependable. Babbitted bearings with precision machined bores and faces. Finished bases.

● **Dodge Heavy Rigid Pillow Blocks.** Rugged, carefully bored, babbitted pillow blocks for many applications requiring grease lubrication. Finished bases and ends.

● **Bearing Units.** A wide variety—spherical seat, cartridge, flange, hanger, screw conveyor hanger, take-up. Ball, Roller and Sleeve types.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."

DODGE

of Mishawaka, Ind.

LUBE LOGIC

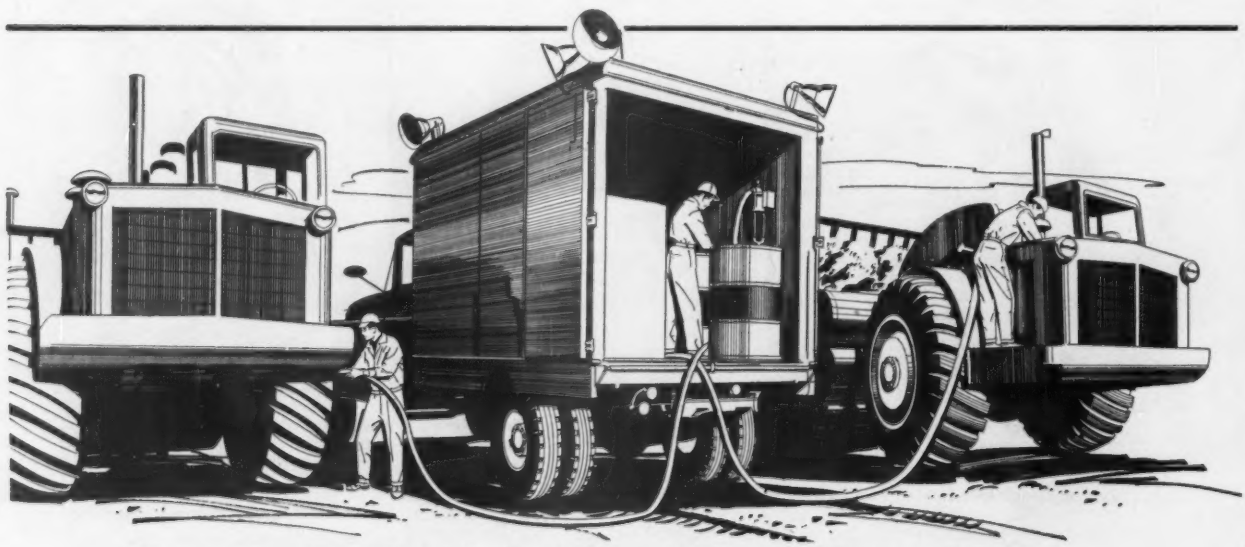
These four tips

Keeping equipment on the job 92% of the time is an achievement anywhere. But when you can do it while operating in sandstorm country, over 12% grades out of a 300′ deep pit to an additional 200′ to top of spoil area, 100 miles from the nearest parts source – and while you're at it remove a million cubic yards of earth every month, it's a record. Maco Construction Co. is doing it right now, and in doing it they've set up such a fine maintenance routine that we think it'll be a help to you to read about it.

What Maco is doing

Maco Construction Co. is stripping the over-burden from uranium deposits recently located in the Gas Hills area of central Wyoming for Western Nuclear, Inc. This is the largest strip mining operation ever attempted in the state, and calls for the removal of 25,000,000 cubic yards of over-burden. In this large open pit, the uranium ore lies from 250′ to 300′ below grade.

Maco is using twenty-two scrapers, six push tractors, two bulldozers, two motor patrols and one backhoe on the job. Texaco fuels and lubricants are used exclusively.



Clean-sweep lube rig handles two machines at once

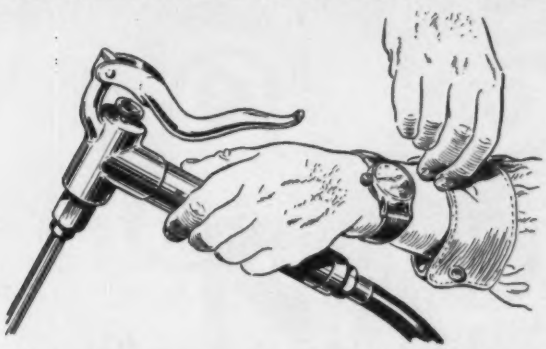
Maco personnel designed and developed a lube rig for this job that is just about as complete as they come – and it has the extra advantage of being able to service two pieces of equipment simultaneously, to make the most of the short period between shifts.

The rig is mounted on a 2 ton van that's kept warm in winter with waste heat from compressor and generator engines. It has two sets of hose reels, one on each side, so that two men can lubricate two different machines at the same time.

Since Maco has a Texaco Simplified Lube Plan, the rig can accommodate sufficient lubricant inventory for the project. Air motors drive the lubricant pumps, and a separate electric air compressor furnishes air. A 25 KW diesel generator set mounted in the van provides power for air compressors, power pumps and the four big floodlights. Maco personnel built the tanks that hold motor oil and hydraulic fluid; transmission and lube grease are pumped direct from original containers.

With this lube rig it's possible for the maintenance crew to lubricate all major equipment in the three hour period between shifts, so no work time is lost.

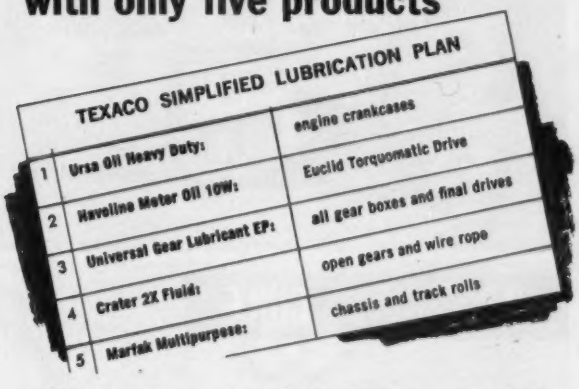
achieved 92% average availability



Clockwork lube scheduling boosts availability

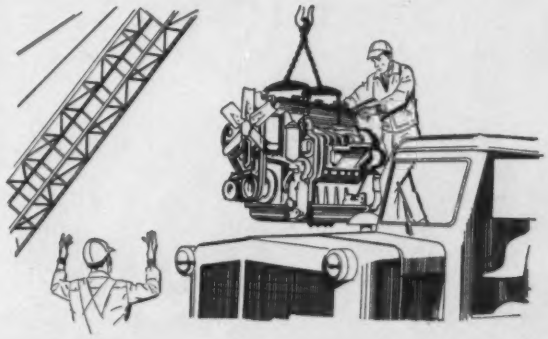
Every machine on Maco's spread is serviced every day, in the period between the close of the day shift, at 4:30, and the beginning of the night shift, at 7:30. The 22 scrapers are lined up in a double row, and the mobile rig passes between them. Every machine is lubricated completely, and air filters are cleaned, at the end of every 10-hour shift. Crankcases are drained every 100 hours. Lube interval on gearboxes and torque converters is 2000 hours.

Simplified Lubrication Plan protects 33 major units with only five products



TEXACO SIMPLIFIED LUBRICATION PLAN		
1	Ursa Oil Heavy Duty:	engine crankcases
2	Havoline Motor Oil 10W:	Euclid Torquomatic Drive
3	Universal Gear Lubricant EP:	all gear boxes and final drives
4	Crater 2X Fluid:	open gears and wire rope
5	Marfak Multipurpose:	chassis and track rolls

With their Texaco Simplified Lubrication Plan, Maco gets fast, thorough, systematic lubrication for all major equipment with the smallest possible lube inventory. This inventory simplifies and speeds up application routine because it avoids confusion, minimizes downtime due to misapplication of lubricants, and lets Maco put their lube inventory on the mobile rig for complete on-the-spot coverage.



Replace-don't-repair theory cuts shop time

Although Maco is well equipped to handle emergency repair on the job, they cut shoptime drastically by sticking to an exchange system on major components like engines, transmissions and torque converters. Duplicate spares of these units are kept on hand. Then the defective unit is simply removed intact from the machine and replaced with a new or rebuilt one. All major repairs on engines, transmissions and torque converters are done at the Rawlins shops. Parts are flown in via Maco's own plane from headquarters in Rawlins, Wyoming.

Minimum downtime on equipment is the principal advantage of the exchange system, but not the only one. For instance, engine repairs can all be made in a fully equipped shop, without having to rush or make temporary repairs; and this system also ensures full availability of the field maintenance crew for their routine work.

Texaco Lubrication Engineers

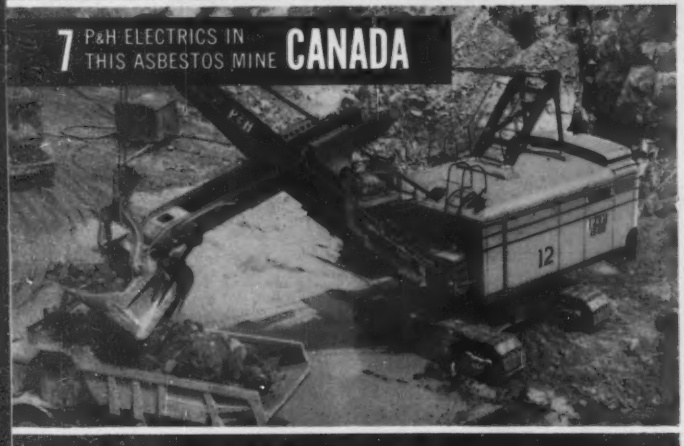
There are 2,300 Texaco Distributing Plants in the U. S. ready at any time to help you develop a Texaco Simplified Lubrication Plan for your next job. Since every Texaco Plan is designed to lubricate specific equipment on a specific job, you'll get the best results by consulting a Texaco Lubrication Engineer. Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

TEXACO

Throughout the United States

Canada • Latin America • West Africa

12 P&H ELECTRICS IN THIS COPPER MINE PERU
12
P&H


7 P&H ELECTRICS IN THIS ASBESTOS MINE CANADA
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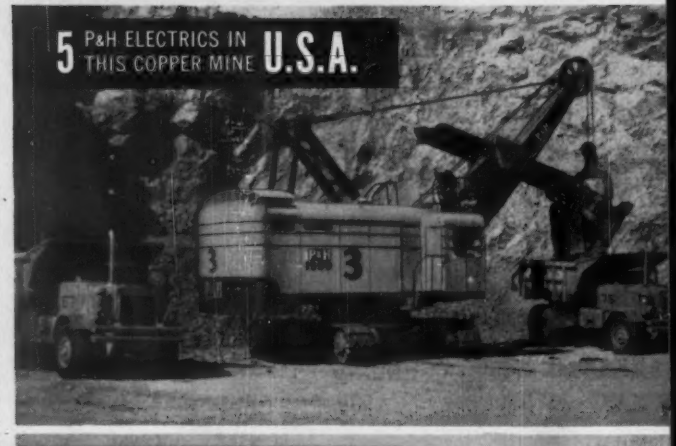

5 P&H ELECTRICS IN THIS COPPER MINE U.S.A.
3
P&H
3

4 P&H ELECTRICS IN THIS IRON MINE U.S.A.
P&H
1400
9
47

9 P&H ELECTRICS IN THIS NITRATE MINE CHILE
P&H
1400
7

...Throughout the Americas...

More mines are STANDARDIZING on P&H ELECTRIC SHOVELS

...more evidence that one P&H always sells another

Look at the evidence: Count the P&H Electric Shovels now in use in each of the mines shown here. It's the same story you'll find in mine after mine: once a P&H electric shovel is on the job, performance records show production increases and lower unit costs that simply make it good business to standardize on P&H. Because more mines are following this trend, Harnischfeger now is the world's largest builder of full electric and diesel-electric shovels.

P&H Electric Shovels incorporate many dramatic new design fundamentals which make them different from all others.

Foremost is MAGNETORQUE® drive—the exclusive *patented* hoist drive that puts more material into the dipper, faster—with every pass! It is the most productive digging motion drive known for electric shovels, producing higher bail pull, greater dipper fill factor and automatic impact protection for the hoist machinery.

FIVE EXCLUSIVE P&H FEATURES

MAGNETORQUE DRIVE
Electro-magnetically transmits full digging power of A.C. motor direct to dipper—without motor generator set conversion to D.C. current.

FULL WELDED STEEL CONSTRUCTION
Unit-welded rolled steel design pays dividends in exceptionally long shovel life in hard digging.

ENCLOSED HOIST MACHINERY
No open gearing—all power trains for hoist, swing and propel drives are enclosed in oil-tight gear cases.

INDEPENDENT CRAWLER PROPEL MOTION
P&H gives you independent motors for each function—the basic principle of electric shovel design and purpose.

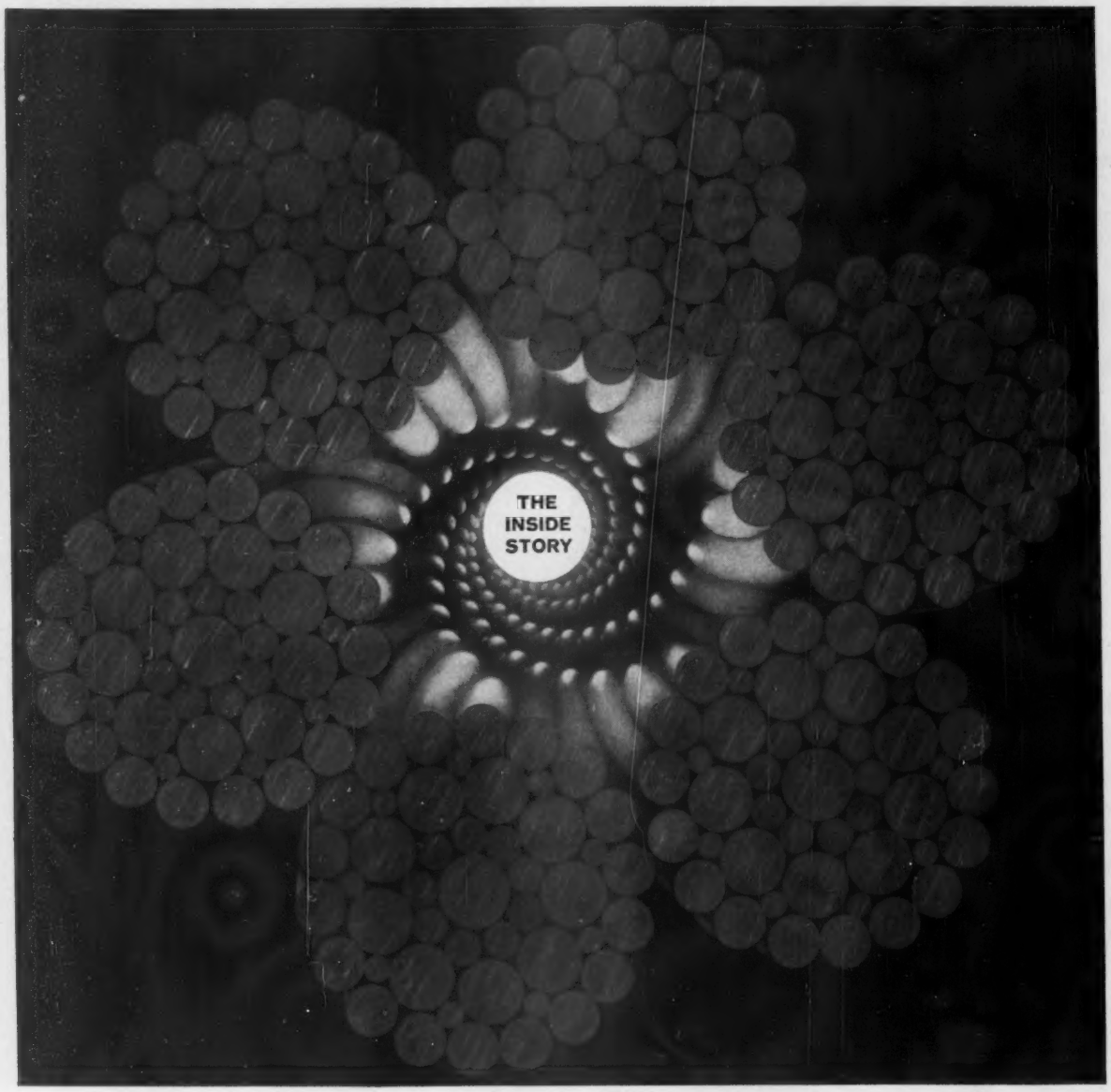
HIGH STRENGTH T-1 STEEL
Only Harnischfeger uses it as *standard* in fabricating a boom and dipper handle with highest impact absorption ability.

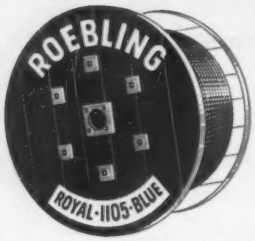
Another major reason why "One P&H Always Sells Another" is single-source responsibility for service. Harnischfeger is the only shovel manufacturer which makes its own electrical as well as mechanical components—all designed and matched by a single manufacturer *specifically for balanced electric shovel production cycles*. For more information write Harnischfeger Corporation, Milwaukee 46, Wisconsin.

SEE US AT THE
AMC SHOW IN LAS VEGAS
P&H BOOTH 503

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
CONSTRUCTION & MINING DIVISION





ROYAL BLUE—*we put a lot of work into it—You get a lot of work out of it.*

ROEBLING ROYAL BLUE WIRE ROPE This is rather a long view of a wire rope that's a real work horse. Time and tests have taught us at Roebling that wire rope users *want* the long view. What else, they say, are they spending their money for?

Here, you're looking through a length of Royal Blue whose core has been removed to show the uniformity and symmetry of the rope structure. You see how concerned we are with internal security.

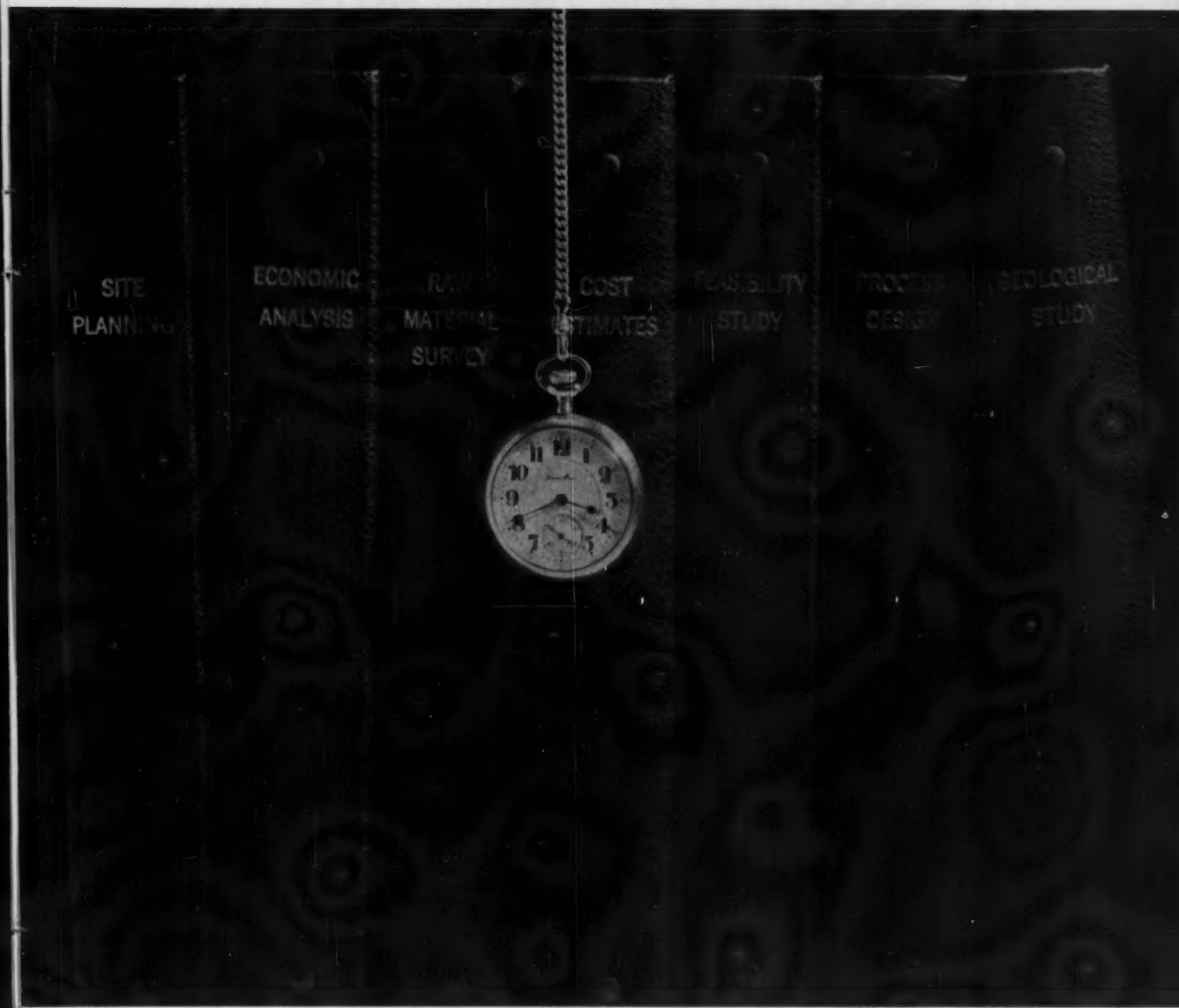
This is one of the reasons why Royal Blue lives up to the day-to-day demands made upon it. High stresses and unavoidable overloads, abrasion, fatigue, impact, crushing, sheave pressures and abusive drum-winding, to name the major ones.

We have to know that the rope we build will do what we sell it to do. Numerous quality-control measures help us—as they do you—to take the long view of Royal Blue. For details about long-lasting Roebling Royal Blue, ask your wire rope distributor or write Roebling's Wire Rope Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities • John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation

Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...



Timely? Many complex factors shape the final decision to proceed with your expansion plans...and timing is an important one. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers is an experienced designer and builder of all types of facilities for the Minerals industry. From Pre-Engineering through design and construction, Kaiser Engineers provides complete, one-company service and ingenuity based on years of experience.

KAISER ENGINEERS **KAISER ENGINEERS** engineers-contractors
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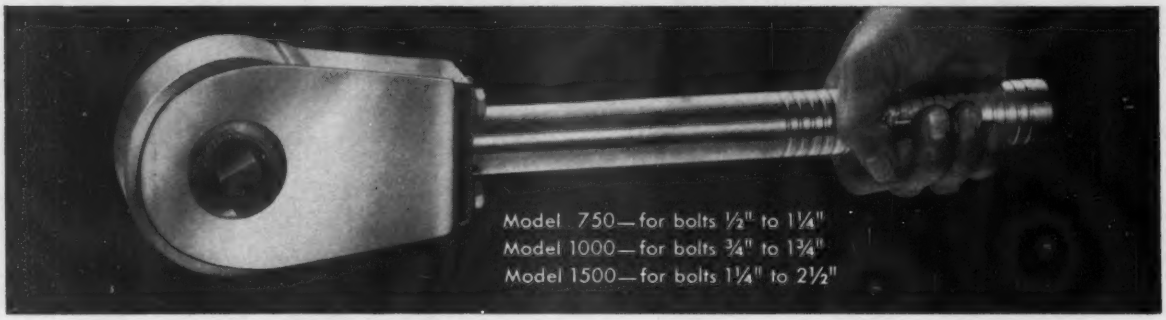
6228-M

designed to solve a universal maintenance problem . . .

first manual impact wrench that works . . .
LOOSENS THE TOUGH NUTS EVEN POWER WRENCHES CAN'T BUDGE!

SWENCH®



• Loosens "frozen" nuts in seconds • Tightens nuts to maximum practical tightness

There's never been anything like Swench before. It is an entirely new concept in wrench design. Swench is the world's *only manual impact wrench.* Here's what Swench means to you . . .

NEW SPEED—Nuts that previously had to be burned off can now be "Swenched off"—with unbelievable ease—by *one* man—in a matter of minutes.

NEW EASE—Only Swench in its torque class is truly portable . . . lets you take the wrench to the job—*anywhere*—with no auxiliary equipment, no power connections.

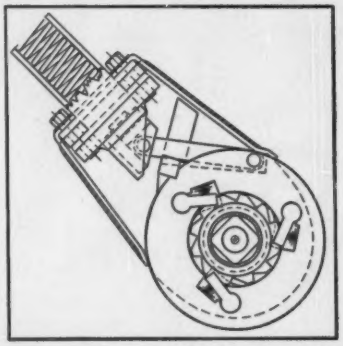
NEW SAFETY—With Swench there's no back-breaking, knuckle-knocking struggle . . . no dangerous handle extensions . . . no sudden release of a frozen nut . . . no shock transmitted through the handle.

NEW POWER—Swench, size for size, gives greater—and more effective—torque than power wrenches . . . multiplies torque applied to handle over 1500% (yet all Swench's power is built into the wrench itself).

NEW ECONOMY—Swench saves in *many* ways . . . no auxiliary equipment to maintain and man, no costly upkeep on the wrench, no man-hours fighting frozen nuts—*and* Swench costs less than half as much as wrenches with comparable impact power.

NEW VERSATILITY—*One* Swench can handle more bolt sizes than any power wrench . . . loosening or tightening requires no special adjustments.

NEW TENSIONING ACCURACY—Precise tightening is assured with Swench, following simple instructions.



INSIDE STORY—How is all this possible? Unlike power wrenches that deliver many tap-like blows, or ordinary manual wrenches that apply steady torque, Swench builds up power in its super-strong spring for a mighty wallop that is released as torsional impact every time the handle is advanced slightly more than 30 degrees.

Write for further information.

See for yourself! Swench is so different from anything you've experienced, you'll have to see it in action to believe it. For a quick and convincing demonstration, contact Marquette.

"When you're up against the tough nuts . . .
Don't wrench it . . . SWENCH it!"

MARQUETTE DIVISION

CURTISS WRIGHT

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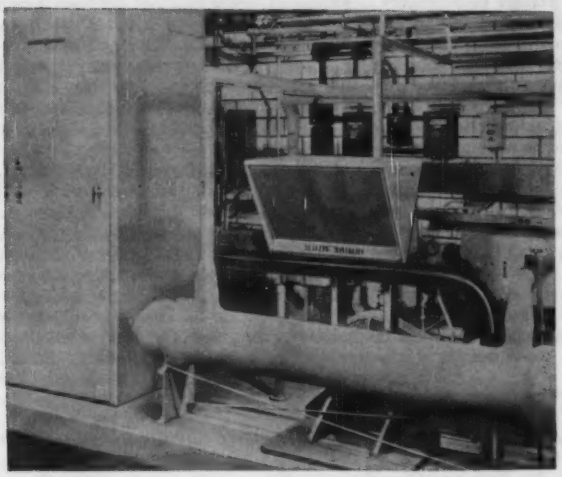
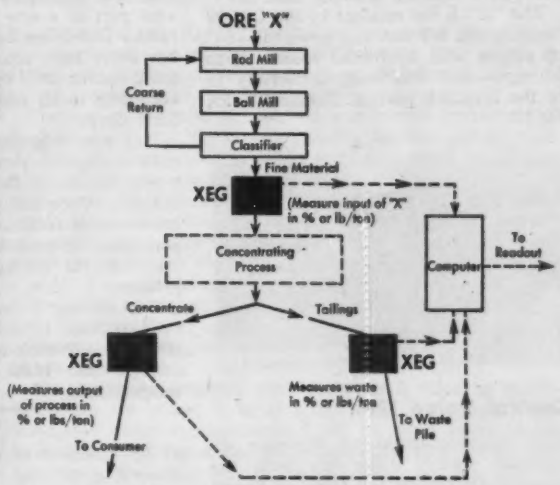
NEW PRODUCTS DIGEST

THIS MONTH'S EXPANDED 12-PAGE REVIEW includes a sampling of significant new products and services from some of the companies that will exhibit at the American Mining Congress' Mining Show, Las Vegas, October 10-13. Though many of the following products will not necessarily be at the listed booths, company representatives at these booths will be able to answer all questions.

New products of some firms not exhibiting at Las Vegas have been included because of their exceptional cost-cutting, time-saving features.

Additional information on *all* of the following new products may be obtained as usual by sending in the attached postcards.





GE X-Ray Unit can Analyze Materials in a Continuous Flow (2)

NEW X-RAY EMISSION GAGE (XEG), developed by the General Electric X-Ray Dept., performs what up to now has been an impossibility—a multi-element analysis of materials in a continuous flow. GE feels that there's now an opportunity to move much of industrial chemistry from the laboratory to the production line.

XEG can simultaneously and continuously check the presence and amount of up to five elements with a reference, and six without a reference. It provides a graphic, on-line analysis of the material's composition, whether in the form of liquid, slurry or solid, as dry or moist powder or sheets. Individual samples of the same material can also be analyzed.

The gage is made up of two components: measuring head and electronic control cabinet. The head houses and mounts an X-ray tube and incorporates collimation slits, analyzing crystals, counter tubes and preamplifiers for analyses of the desired materials and a suitable reference radiation. The control cabinet is designed to house and mount all of the power and measuring components.

GE said that once the XEG is set for a specific analysis, the cabinet's access door can be closed and locked. Switches for line voltage and X-ray OFF and ON are located on the outside of the door and control operation.

Output from the gage is used for computing, control and indication, and can be calibrated to show any desired measurement—per cent, lb per ton, tons per hr, etc.

Photograph shows a typical XEG installation—control cabinet is at extreme left; measuring head is the unit bearing the GE nameplate. The flowsheet outlines one of the almost limitless XEG applications. Here it operates as a control on the concentrating process. **Booths 634, 638**

Inclined Skips (14)

NEW BOTTOM-DUMP INCLINED SKIP, Jetincline, that can be run at any angle between 15 and 60, has been developed by Lake Shore, Inc., Iron Mountain, Mich. Units up to 50-ton capacity have been designed.

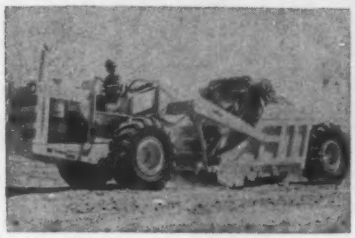
A truck behind the body of the skip opens the door by riding the higher rails of the scrolls, while the rear truck of the body, which is narrower, descends to the lower rails. Skip body rotates gradually, and minimum shock is transmitted to headframe.

Sticky ore that has accumulated at the lower edge of the bottom is scoured away by loose ore brushing past as the skip is dumped. Lake Shore said that, for extremely heavy duty, some of the skips have been built with 36-in beams across the bottom. **Booth 543**

Self-Loading Scraper (13)

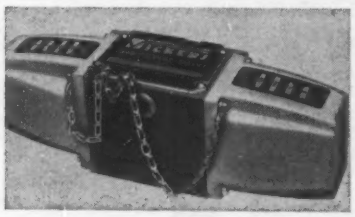
A TWO-UNIT COMBINATION (the Le-Tourneau-Westinghouse "D" Tournapull and Hancock Mfg. Co.'s Model 10E2 elevating scraper) is a new, efficient, large-capacity machine for jobs where self-loading is mandatory.

Because of the exclusive "chopping action" of its slat-type elevator, Hancock's 10 cu yd Model 10E2 will load in surprisingly short time under moderately difficult conditions. The elevator's



soil-pulverizing action makes spreading easy and uniform and eliminates the need for a separate finishing tool.

The "D" is the smallest of the LeT-W Tournapulls. It's fast and powerful—143 hp engine with haul road speeds up to 30 mph—and was built exclusively to be the Hancock partner. **Booths 37, 39, 66, 68**



Control Valve (26)

NEW SOLENOID-OPERATED four-way directional control valve has been announced by Vickers Inc., Div. of Sperry Rand Corp.

The valve has a nominal rating of 8 gpm and can handle flows up to 12 gpm without strain. Vickers said that for its size, the unit has the highest flow capacity, at reasonable pressure drops, of any available valve. Sub-plates have ⅜-in. ports, or ½-in. ports to take advantage of the larger flows. Maximum recommended operating pressure is 3,000 psi.

Wheeled Tractor (17)

HERE IS THE LATEST ADDITION to J. I. Case Co.'s line of wheeled tractors—57 hp (gasoline or diesel) Model W-3. According to the company, the outstanding features of the new machine are: torque-converter drive; synchronized shuttle transmission; power-steering and 7,000-lb capacity front axle.

W-3 was designed primarily as a 2,500-lb capacity loader and 3,000-lb capacity backhoe, but can also be used with a wide choice of interchangeable equipment, including crane boom, post hole digger, dozer, and scarifier-scraper.

The new, heavy-duty backhoe digs to a depth of 14 ft—reaches 20 ft from the front axle. It features foot-operated 180° swing and double-acting swing cylinders that allow swinging boom at full speed with a cushioning effect at the end of the stroke. **Booth 210**

New Reducing Method May Boost Southwest Copper (60)

HUGE STAINLESS STEEL indirect-fired calciner (48 ft long and 54 in. in dia) is a vital part of a new project to profitably reduce lime-laden copper ore that so far has never been economically treated by more conventional ore reducing methods, according to its manufacturer, Standard Steel Corp.

The new reduction scheme is the salt coke segregation process—it could spark a new interest in the southwest's copper industry. A somewhat similar process has been used in Africa. However, this is the first time indirect-fired equipment has been used in the salt coke segregation process.

The calciner is made from Allegheny Ludlum Steel Corp. Type 316 stainless steel plate, which is needed to retain strength and resist oxidation at high temperatures.

Standard Steel had designed and built the calciner for a copper producer in the southwest where much of the copper cannot be recovered by the acid-leach reducing method. The lime and other foreign materials in the ore use expensive sulphuric acid intended to extract the copper from the ore. Until recently, such ore has been ignored by commercial producers.

In the conventional acid-leach process, ore is leached with dilute sulphuric acid or with acid-ferric sulphate. The copper is recovered from solution by electrolysis.

The salt coke process feeds crushed ore along with coke and a halide salt into the calciner where it is heated and mixed—producing metallic copper. From the calciner, the mixture goes through a cooler, into a ball mill classifier circuit, and then to flotation cells. **Booth 239**

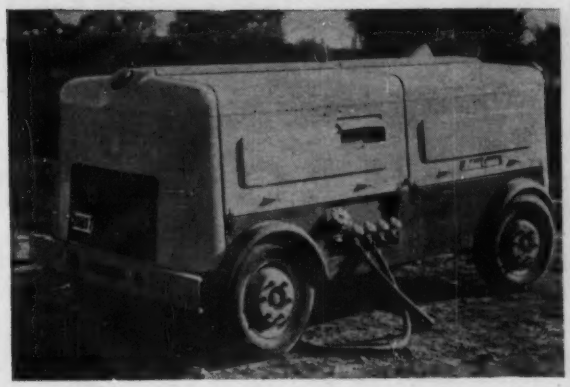
Carbon-Arc Lead Burner (16)

A NEW CARBON-ARC LEAD BURNER, designed by the Exide Industrial Div., Electric Storage Battery Co., to be carried in a mechanic's tool box, is a handy means for making emergency, on-the-job repairs to industrial storage batteries and for general heating jobs, according to the manufacturer.

By attaching the screw-on clamp at the end of the cable to the metal strap between three series-connected lead-acid cells, the flameless electric burner will heat with the power from the battery being repaired. To use an automotive

battery, the clamp is put on the positive post with the work connected to the negative post to complete the circuit.

Equipped with a pencil-tip carbon heating rod to melt the lead, the burner is much faster and more convenient to use



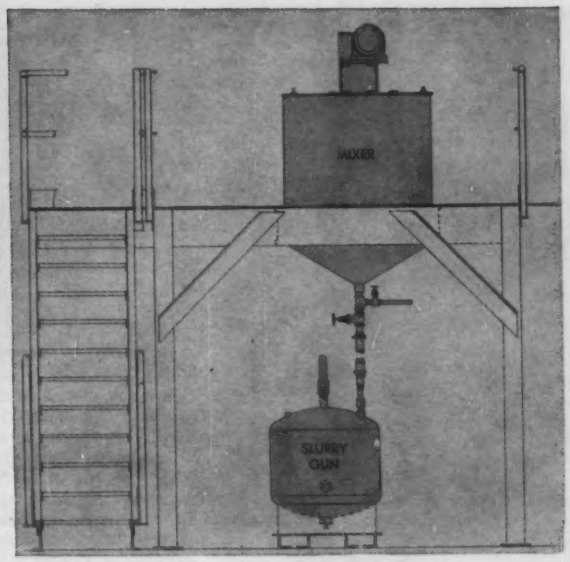
Portable Rotary Screw Compressor (55)

PORTABLE VERSION of the two-stage rotary screw compressors which are oil-flooded (no metal-to-metal contact) and which are suitable for all types of weather conditions, will be shown at Las Vegas by Atlas Copco Pacific Inc.

Basic parts of the machine, Copco reported, are two accurately intermeshing helical rotors surrounded by a closely fitting casing. As these rotors revolve, the air in the interlobal spaces is forced towards the compressor's outlet end by the slide valve action of the intermeshing lobes—lobe of one rotor rolling along the groove of the other and pushing the enclosed air ahead of it. The compression continues until the outlet end of the groove rotates into line with the outlet port in the casing. The air is then forced smoothly into the outlet port until the intermeshing lobe reaches the end of the groove. At this point, the next groove has already come into line with the outlet port, giving pulsation-free air delivery.

The Twin-Air Model No. PR-8 (600) is powered by an 181 hp GM 6V-71 diesel engine and delivers 600 cfm. It's mounted, Copco says, on a rigid frame equipped with fully independent four-wheel torsion bar suspension and automotive-type steering, designed for swift, safe transport over any terrain.

According to the company, some more advantages of the portable Twin-Air compressor are: 24v electric push button starter works well under severe conditions; compressor is protected by oil bath filters with cyclone separators, designed for trouble-free service under extreme sand and dust conditions; the two-stage design gives maximum efficiency and economy, and allows oil injection at each compression stage to make sure that there's adequate sealing and lubrication; all bearings are SKF roller type which have very small clearance — clearances between rotors is kept at a minimum, resulting in increased efficiency. **Booth 627**



Furnace Protector (34)

HARBISON-WALKER REFRACTORIES Co. has come up with a new slurry-mix, mixer and gun combination that makes it possible to apply suitable hot patching material to all vital parts of open-hearth furnaces.

The system can also be used on non-ferrous furnaces. For example, H-W said, the copper industry has successfully used the mix for maintaining sidewalls and other areas of refining furnaces that are exposed to corrosion.

The mix, H-W Gunshot, is a fine-ground refractory material which is supplied in both chrome base and chrome-magnesite base. Both modifications have fast-setting bonds which develop high strength when properly applied.

H-W Gunshot is mixed by a paddle-type, electrically-driven tank mixer, which has a steam jacket attachment to help activate the plasticizers, assuring maximum material adherence. Mixing operation calls for adding forty-five 100-lb bags of H-W Gunshot to 150 gal of water.

The company's pressure vessel-type gun is filled by gravity flow from the mixer. It holds 1,500 lb of slurry and, when filled, will weigh approximately 2,300 lb. After being placed in front of the furnace, the gun is connected to 80-lb pressure air source. Two men, one at the gun valve and the other at the nozzle, can apply the entire 1,500 lb in about 10 min.

for removing connectors than drilling out terminal posts, Exide claims. It can be used with chisel-point heating rods to weld terminal-post seal rings found on stationary type batteries as well. **Booth 129**

Two New Macks (49)

MACK TRUCKS INC. will introduce two completely new, off-highway, rear-end dump trucks at the October Las Vegas show. The M40SX is a 40-ton, six-wheel unit with two-man cab; the M30X, a 30-ton, 18-yd capacity two-axle truck.

The company said that sheet metal has been re-designed on both M series trucks, placing the cab and driver farther forward and to the left—achieving a better load distribution and better driver visibility forward and aft. A high capacity front axle and 18 x 25 tires have been provided to accommodate maximum front axle loading. **Booth 17**

Radiation Counter (8)

URANIUM INSTRUMENTS Co., Grand Junction, Colo., has developed a radiometric probe that can separate background radiation from that originating at an ore face or stock pile. According to Urinco, when the ore face or stock pile is equal in volume to an infinite hemisphere (18-in. radius) and the material is in radiometric equilibrium, U_3O_8 content may be recorded by getting a difference between two count rates read out on a transistorized counter. The difference between the two count rates, when multiplied by a coefficient, will yield the per cent of contained uranium.

Urinco's Model VLS scanning method assumes that the sample being assayed has constant mass absorption.

Portable Hardness Tester (15)

EASY-TO-OPERATE portable hardness tester, accurate to plus or minus one point of Rockwell hardness, is available from Advance Industries, Inc.

Called Magnedyne, the unit provides accurate readings on both curved and flat surfaces and on any size material. Because it's magnetically attached, it can

be used in almost any practicable position without impairing accuracy.

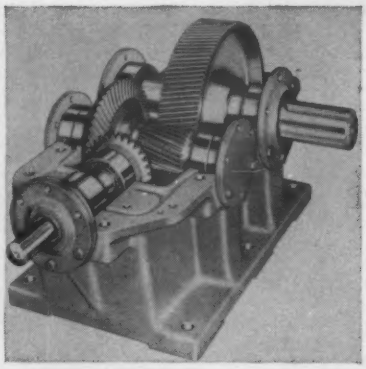
The company stated that Magnedyne is lightweight and completely portable

in its protective case. There are no weights, pulleys or knife edges to become affected by dirt and dust.

The instrument has a built-in demagnetizing device for use on test specimens of different coercive values. In all, Advance said, an inexperienced person could be trained to perform accurate tests in a few minutes.

Speed Reducers (19)

HEWITT-ROBINS INC. has developed a new line of spiral bevel speed reducers that take up less floor space than most other reducers. The new units have a



right-angle shaft arrangement which makes it possible to place the prime mover alongside the driven equipment.

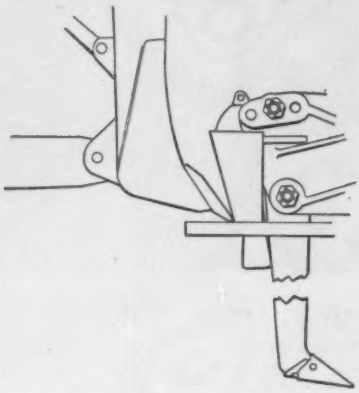
The spiral bevel gears are, according to H-R, more efficient than worm gears used in right-angle drives—in many applications, they make it possible to reduce the size of the motor, controls and accessories. The energy loss for a single reduction spiral bevel reducer is approximately 2%. For a double reduction, it is 3%, and, for a triple reduction, 4%. **Booths 1305, 1309, 1311, 1313, 1315, 1400, 1404, 1408, 1410, 1412, 1414**

Tandem Ripper (7)

ONE-PIECE TANDEM RIPPING PUSH BLOCK that transmits push tractor force directly to the ripper shank—minimizing bending forces on the shank—has been developed by Caterpillar Tractor Co. for its No. 8 and No. 9 rippers.

The push block is mounted on the rear of the five-position clevis. It's pinned at the top through the rear clevis pin hole and needs no welding or cutting for installation.

When operating, the tractor blade rests in the "V" formed at the junction



of the vertical block and a horizontal plate. The block extends below the plate and touches the rear of the ripper shank near ground level.

Caterpillar said that by keeping the contact point so low to the ground and by not having the pushing force go through the clevis, pins and beams, the ripper shank is subjected to much less bending force. **Booths 315, 319, 325, 331, 414, 418, 424, 430**

Improved D7 (50)

CATERPILLAR'S NEW D7d tractor has greater power, decreased maintenance requirements and higher lugging ability, according to the company.

A major new feature of D7d is a dry-

New Crawler Rig (36)

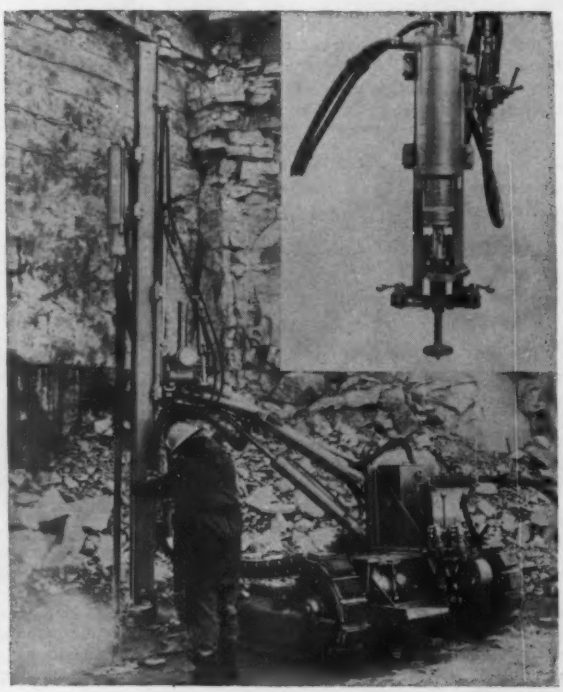
TRAC-NEWMATIC, a crawler drill rig designed by Westinghouse Air Brake Co.'s Le Roi Div. for fast, economical drilling of vertical, horizontal and angular primary and secondary blast holes, is available in two models.

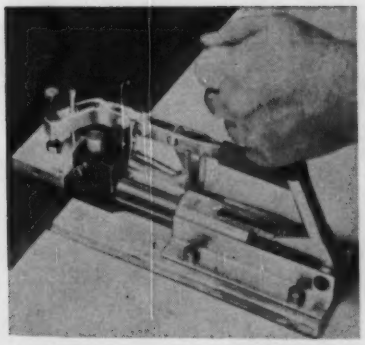
The LDC-500R, mounting a new striking-bar type 5-in. drifter, drills 4-in. holes in as little time as normally needed for 3½-in. drilling. A similar type 4-in. drifter used on the LDC-400R Trac-Newmatic does the same job for the 2½- to 3-in. range. Both drills have forward, neutral and reverse rotation for quick drilling, extracting tight steels and working with coupled steels.

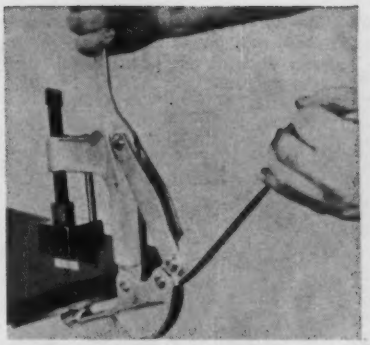
An air motor driven hydraulic pump powers and controls the raising, lowering, swinging and dump operations of the feed and support arm and the sliding action of the cone. The operator can drill a wide pattern because he can swing the support arm over the crawlers from center line to 60° left and 45° right.

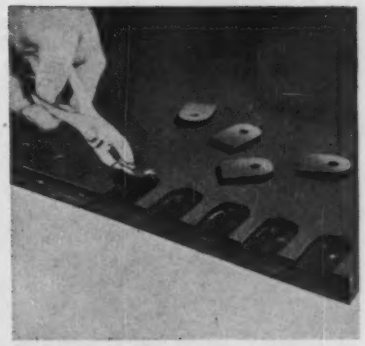
Oscillating-type crawler assemblies are controlled and gear driven by individual 7½ hp, reversible, piston-type air motors. Tramming speeds range to 2 mph when pulling a Le Roi 600 cfm rotary compressor. With compressor in tow, grades of 10% are easily handled.

Low center of gravity and 10-in. wide tracks give good tramming and drilling stability when working in rough areas. Tracks are spring-loaded to maintain the right tension and are easily adjusted. **Booth 21**









Two-Tool Team Countersinks Fasteners for Added Belt Life (24)

FLEXIBLE STEEL LACING CO. has designed and built a two-tool combination that makes it possible to countersink their Flexco belt fasteners.

First step in the operation is to cut into the belt horizontally (left) above the load-carrying fibers. After all the horizontal cuts have been made, the vertical countersinking tool (middle) makes the downward incision.

Though the vertical cut doesn't go all the way through to the horizontal, it does go deep enough so the cut sections can be pulled with pliers (right).

Result of countersinking, Flexible says, is that it permits clean scraper operation, lengthens fastener life, reduces noise on return idlers and minimizes idler bearing wear. It also cuts down the overall belt thickness at the joint—permits using a smaller size fastener. Splice life is thereby increased because belt flexing at the joint is greatly reduced. **Booth 342**

type air cleaner which makes possible more efficient intake-air filtration and reduced servicing time.

Caterpillar also said that power train components show refinement over the earlier D7 model. The transmission lubrication system has full flow filtration, with pressure-lubricated bearings. To assure maximum lubrication of transmission gears, they operate under a continuous spray of oil.

The pitch of final drive gears has been made coarser to provide beam strengths 16% greater in the idler position and 49% greater in the final drive gear. **Booths 315, 319, 325, 331, 414, 418, 424, 430**

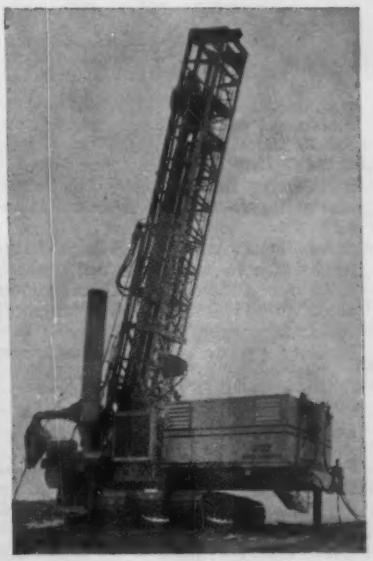
One-Man Magnetometer (52)

GEOPHYSICAL INSTRUMENTS & SUPPLY CO.'s Abem torsion magnetometer Model MZ-4 is a one-man instrument which does not require any assistant field operator—orienting compass is permanently mounted on the instrument.

MZ-4 was designed for mineral exploration, mapping contacts, and locating magnetite and pyrrhotite. It has an over-all accuracy of three gammas and a reading accuracy of one gamma.

The 33° wide angle ball and socket joint on the tripod head eliminates the need for a leg extension when measuring over a steeply sloping terrain, and makes it possible to set the tripod down on moderately sloping ground without worrying about the position of the legs.

Single-handed measurements may be taken. The observer is therefore able to shield the magnetometer against snow or rain and to illuminate the eyepiece at night. **Booth 809**



Angled Blast Holes (45)

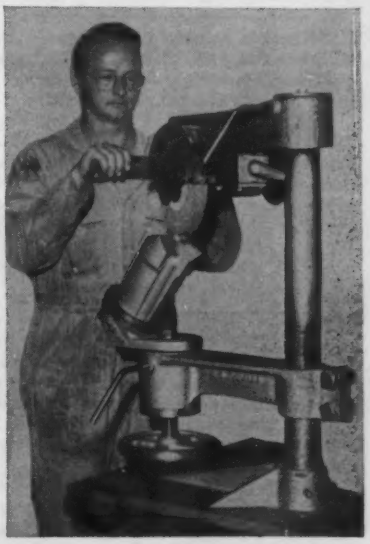
JOY MFG. CO.'s 965-BH Champion rotary blast hole drill (which the company will show at the American Mining Congress Show in October) puts down angle holes as well as vertical holes. Mast and rod handling facilities tilt to 30° off vertical, powered by hydraulic cylinders.

Machine features overhead drive with four-step variable transmission to provide adequate torque at all rotation speeds. **Booths 200, 300, 51**

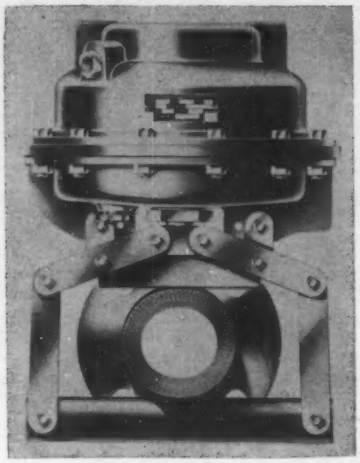
Improved Bit Grinder (51)

GARDNER-DENVER CO.'s easily assembled and disassembled Model G4 bench-type bit grinder is designed to sharpen any detachable bit up to and including 5 in. in dia. It can do this with greatly reduced grinding time—has a controlled grinding-wheel movement and built-in fixtures.

Some of G4's other features, as cited by Gardner-Denver, include: self-aligning detent pin which locks in place after each grinding; rectangular base with



three bolt-holes that can be easily and securely mounted on any bench; Model L012 automatic line oiler that furnishes constant lubrication—provides smoother lubrication with lower oil consumption. **Booth 1100**



Automatic Valve (25)

NEW AUTOMATIC FLEX VALVE has been developed by Farris Flexible Valve Corp. to control the flow of highly abrasive and corrosive materials in locations considered too hazardous or inaccessible for manually operated valves.

Farris' valve has a simple pipe-like body which gives full capacity and unobstructed flow—it will not plug. The unit will not freeze, and the flexible body absorbs vibration and is unaffected by water hammer.

The Flex Valve is available in a wide range of body materials (pure gum rubber, Buna S, Buna N, Neoprene and Butyl or compounds of each) and sizes range from 1- to 12 in. According to the company, the valve is easy to install—just slide body over connecting piping and tighten clamps. **Booth 618**

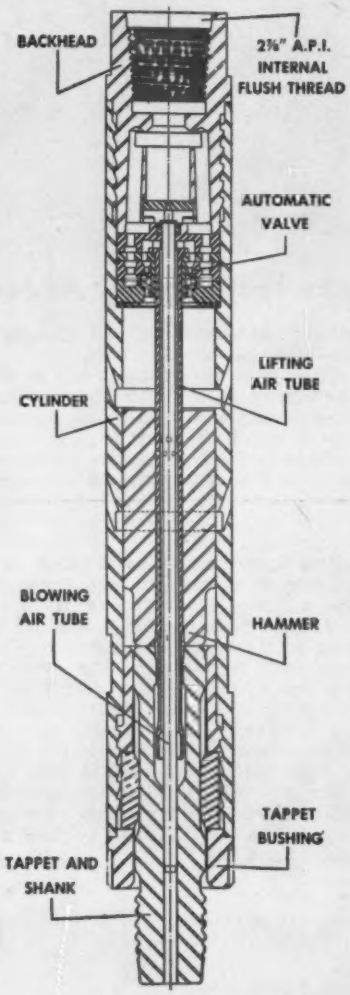
CLEVELAND'S ARTHUR G. MCKEE & CO. will buy Western Machinery Co., San Francisco, according to an announcement by both company presidents.

McKee's president, H. E. Widdell, and Jack H. How, head of Western Machinery, said the transaction will be done with cash and notes and will not involve issuance of any additional McKee common shares. They also said that Western Machinery will be operated as a McKee subsidiary with no changes in present management or personnel.

Expanded "Mole-Dril" (10)

"MOLE-DRIL" IS NOW BEING OFFERED in three sizes ranging from 4- to 6-in. dia, according to the Gardner-Denver Co.

The three new percussion types (AM4, AM5 and AM6) screw directly onto drill pipe and work at the bottom of the hole directly on the rock face. There is no power loss between the hammer and the bit, regardless of drilling depth. Positive hole cleaning is maintained by air through the air tube to the bit.



"Mole-Dril" has only three moving parts (valve, hammer and piston) which makes it easy to disassemble and maintain.

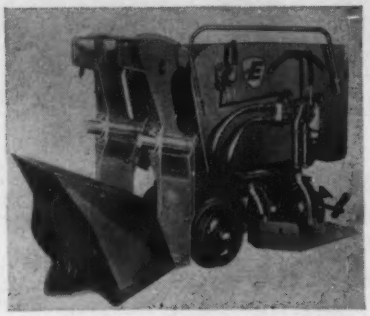
Additional features include a backhead which has a positive action check valve for drilliing in wet formations; automatic drifter-type valve for short stroke fast action. The cylinder is carburized for maximum abrasion resistance.

Cross-section is of the Model AM5A (5 in.). **Booth 1100**

Latest RockerShovel (23)

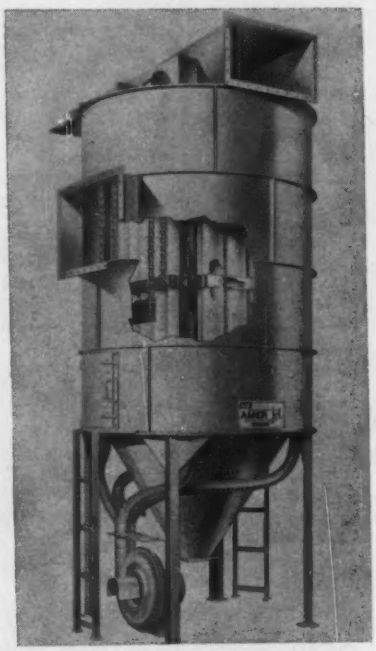
PART OF EIMCO CORP'S presentation at the Las Vegas Mining Show will be the unveiling of its latest underground loader, the 24 RockerShovel.

The Eimco 24 replaces the company's 21 RockerShovel and contains the following new and important working features: replaceable rail design; patented arrangement of bumper springs in the arm—springs enclosed in cylinders; involute rail thrust ends, for constant arm contact during the dig-out cycle; improved bucket discharge and arm roll down and expanded range of discharge heights; greater bucket capacity for faster loading; increased clean-up width, digging force and provision for digging below



rail depth; and improved bumper springs for greater stability at discharge.

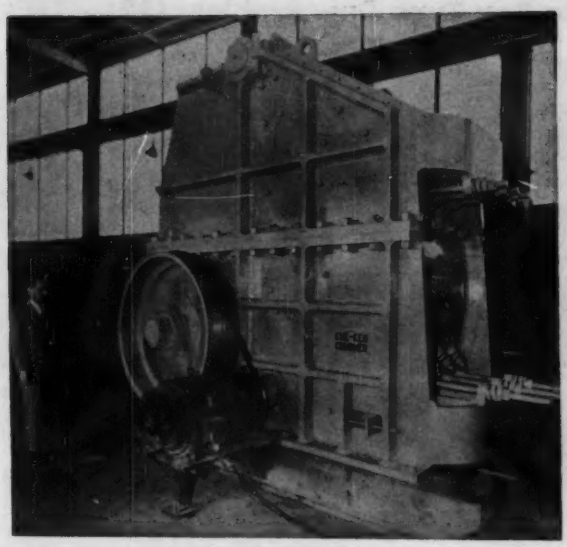
Eimco reported that all existing Eimco 21 RockerShovels can be converted to the new model and be made to incorporate the increased strength and productivity. **Booth 401**



Reverse-Jet Collector (48)

AMERICAN AIR FILTER CO.'s new Model B AMERjet is a reverse-jet, compact, low-cost fabric dust collector designed especially for collecting extremely fine particles and collecting them in a dry state.

AAF said that periodic lubrication is all but eliminated on its unit since sprocket drive bearings are pre-lubricated and only two gear boxes are needed. Since the heart of the reverse-jet cleaning mechanism utilizes a high pressure or positive displacement blower, several types of intake air filters are offered (based on environmental dust conditions and specific maintenance requirements). **Booth 611**



Easy-Running Crusher (30)

BY HAVING A SWINGING JAW mounted on a hinge pin in the center line of the crushing zone, excess power requirements have been eliminated for Straub Mfg. Co.'s latest jaw crusher. Result? A massive 48 x 42-in crusher with an exceptionally small flywheel that starts with a 30-hp normal-duty motor and operates at full load on a maximum of 150 hp.

The pictured unit is running smoothly and vibration-free at 275 rpm while mounted on skids that aren't fastened to the floor.

Versatile Crawler (56)

THE C-6, which GM's Euclid Div. calls the most versatile crawler in its class, "moves bigger obstacles, makes more passes, loads more scrapers and goes more places" than crawlers of similar weight.

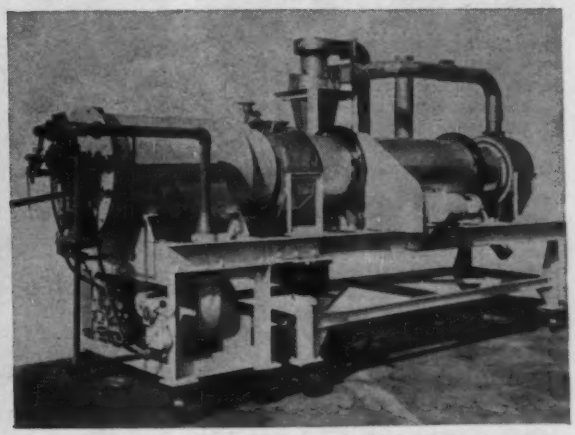
The C-6 has a low center of gravity—can work most slopes and difficult ground. It responds instantly—reverses quickly, turns smoothly and easily, and shifts on the go.

Big feature of the new crawler, Euclid claims, is that it lubricates easily. It has fewer components to service and they're easier to reach—drive train components are replaced in a fraction of time ordinarily required. **Booths 307, 311, 400, 406, 410**

Pilot Dryer (37)

STANDARD STEEL CORP. will use AMC's Las Vegas show as an opportunity to present its new, highly versatile pilot dryer.

According to Standard, the machine can be used to test dry material under varying flows, temperatures, and flight arrangements. The 15-in. by 8-ft pilot unit can be set up for either counter or parallel flow at both high and low temperatures. It can also be adapted to use steam-heated air for low-temperature drying applications.



The type 316 stainless steel dryer is mounted on an adjustable pitch bed frame. Its cartridges are interchangeable, and a special refractory lining enables it to be used as a rotary kiln. **Booth 239**

40-Ton Dumper (29)

KW-DART TRUCK CO. recently introduced a new 40-ton capacity end dump truck, the 40SL, that's reported to be the largest capacity two axle dump truck ever placed into service.

The 40SL is 30-ft long, 13-ft high and 12-ft wide, and is powered by a V-12 diesel engine coupled with a four-speed transmission-converter. **Booths 425, 431, 524, 530**

Supertherm, New High-Temperature Alloy (33)

SUPERTHERM, THE TRADE NAME OF A NEW ALLOY which has been field tested and proved outstanding for use in temperatures ranging up to and including 2300°F. has been developed by Electro-Alloys Div., American Brake Shoe Co.

The company said that the alloy, with its superior high temperature properties and good foundry and weldability characteristics, will find extensive use in the 1800-2300° F range. Some of its prime immediate applications are: heat-treat-furnace parts for the steel and automotive industries, cement kiln parts, and smelting furnace and calcining furnace parts.

SUPERTHERM composition is:

Chromium	26%
Nickel	35%

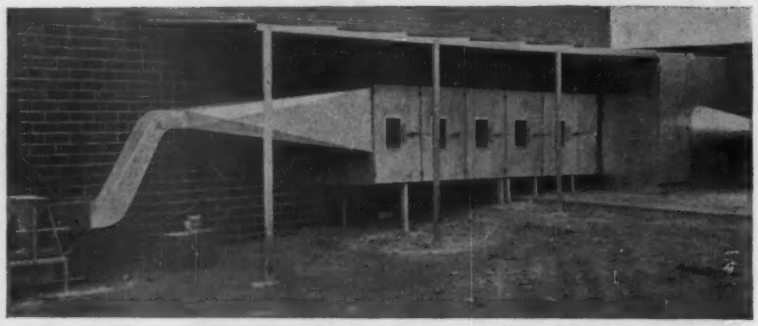
New Electrostatic Collector Can Handle Any Type Dust Problem (12)

A RAND ENGINEERING COMPANY (South Africa) has applied for world patents for an electrostatic heavy dust collection unit, claimed by its inventor, Abe Kadish, to be the world's only unit designed to handle just about every type of dust at an efficiency rate of between 99 and 99.9%.

The unit—a pre-and-after filter—is an offshoot of a range of electrostatic filters made by Mr. Kadish's firm, Collectron Industries Ltd., Johannesburg, for a wide range of industrial applications. The company has now gone into the specialized field of heavy dust extraction.

Basic principle of the new unit is the electrostatic attraction that two bodies with opposite charges have for each other. Putting this principle to use in a filter makes possible the production of ultra-clean air.

With the Collectron unit, dust particles are positively charged by ionized elements of fine tungsten wire. These impinge on tubes of opposite polarity which are spaced out in banks.



A fan at the outlet end draws the dust-laden air through the filter, where the dust particles are held by the collecting electrodes. When the unit is switched off, the particles fall from the bars and can be collected in storage tanks, then removed by conveyor belt.

One company demonstration unit is fitted with five storage tanks. The first tank lies beneath the feed-in duct and first prefilter screen; the next three are fitted below the next three prefilters; and the fifth is fitted below the final "efficiency cell" at the outlet end. This model is designed to handle 1½ cu ft of dust per hr. For demonstration purposes, 6 cu ft were fed in 40 min. Although greatly overloaded, the unit handled the whole input with close to 100% recovery.

Carbon	0.50%
Manganese (max.)	0.70%
Silicon	1.60%

This composition is strengthened and stabilized with cobalt and tungsten, a key to its exceptional capability. Patent is pending on the composition.

Most important high-temperature properties may be tabulated as follows:

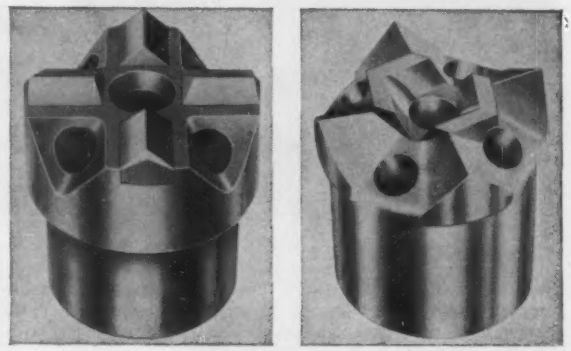
	Temperature			
Property	1800 °F	2000 °F	2200 °F	2300 °F
Tensile strength (psi)	21,700	12,900	5,400	2,100
Yield strength (psi, 0.2% Offset)	17,100	10,950	4,000	1,500
Elongation in 2 in. (%)	25	24	45	50
Reduction in area (%)	42	46	62	65
Oxidation resistance (in./yr)	.006	.009	.025	.044
Stress for rupture in 100 hr (psi)	7,000	3,500	1,250	500
Stress for rupture in 1000 hr (psi)	4,500	2,200	700	150
Stress for rupture in 10,000 hr (psi)	2,900	1,250	150	*
Limiting creep stress (psi)	3,200	1,700	350	100

*Not currently available.

Enlarged TD-25 (58)

FOUR INTERNATIONAL construction equipment units and three International trucks will be displayed during AMC's October show. In the group will be the TD-25, newest heavyweight crawler of International Harvester Co.'s Construction Equipment Div. The 230-hp turbocharged TD-25 will be fitted with an Ateco ripper on the rear and a hydraulic dozer blade up front.

The TD-25 is approximately 3,500 lb heavier than the TD-24. It has a new dry-type air cleaner that gets 99.9% of impurities out of combustion air for longer engine life. The new three-stage torque converter increases torque amplification, gives drawbar pull up to 70,000 lb at 0.75 mph with adequate weight and traction. **Booths 435, 439, 534**



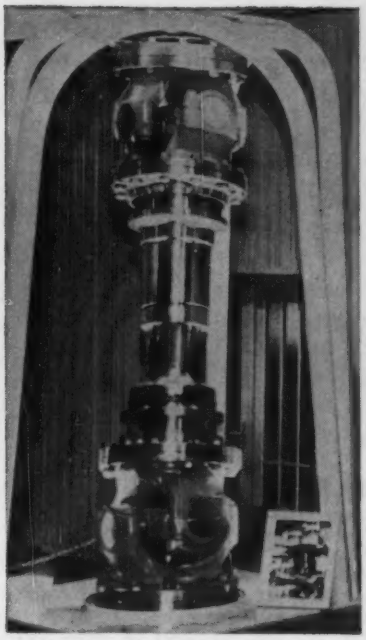
Low-Cost Footage Bits (35)

WESTERN ROCK BIT MFG. Co. has developed two new "one-use bits" for dustless vacuum type drills.

The WRB Tee Cee type TCVA or TCVB (left) is a shallow tungsten-carbide insert bit for either class A or class B taper connections. Western said that the long-life heavy-duty tungsten carbide insert bit needs no resharpening and was designed to give low-cost footage.

WRB type SLVA or SLVB bit (right) is a low-cost "used to destruction" steel bit. Outstanding feature of the WRB is its pilot construction and wing design. The pilot chips the rock ahead of the cross wings and eliminates the pulverizing action common to conventional cross bits.

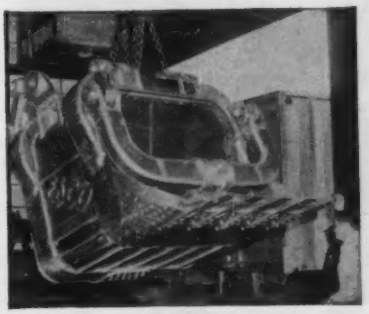
Both bit types are five-hole design and are interchangeable. **Booth 219.**



Giant Universal Joint (46)

TWIN DISC CLUTCH Co. recently announced that, through an exclusive licensing agreement, it will be offering the complete line of Gelenkwellenbau universal joints throughout the U.S.

The photo shows part of Twin Disc's Las Vegas exhibit—the world's largest roller bearing double universal joint. Large joints of this type are used on ore processing machines. **Booths 1312, 1314, 1316**



Aluminum Dipper (5)

ALCOA HAD the Electric Steel Foundry Co. build them an all-aluminum dipper for their Dominican Republic bauxite operations.

Because it's all of aluminum (plate, welding wire and rivets), the dipper has increased the normal capacity from 4½ cu yd to 5½ cu yd, without a corresponding increase in weight.

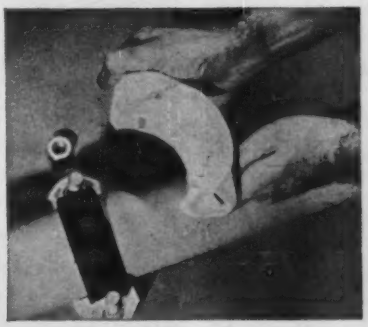
Igniter Tester (9)

NEW COMPACT TESTER that can quickly and safely check explosive igniters, detonators, primers or squibs and can perform the same functions as many testers that are several times larger has just been developed by Kinematics Corp.

The new instrument uses a sensitive bridge circuit—maximum test current is

limited to 10 milliamperes, so there's no danger of setting off igniters during the test.

Kinematic's tester is designed for convenience. It may be held and operated in one hand—the whole unit weighs less than one pound. A simple digital readout indicates whether the tested device will operate properly or misfire.



Pipe Connector (62)

NEW TIME- AND MONEY-SAVING method of connecting standard-weight plain-end pipe, called Plainlock, will be displayed at Las Vegas by Victaulic Co. of America.

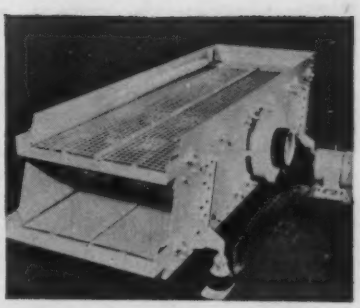
Plainlock secures pipe or fitting ends with a positive metal-to-metal engagement. The couplings have built-in hardened stainless steel grips that indent and mechanically lock the pipe ends.

Every Plainlock connection provides a union at each connection. Pipelines can be easily and quickly dismantled for clean-out or repair.

Plainlock couplings require less space and are easier to position with accessible nuts and bolts than sleeve-type bolted coupling or flanges. **Booth 347**

Vibrating Screen (11)

ECONOMICAL TY-ROCKET LINE of vibrating screens, constructed along a modular design so that several different sizes can be assembled from standard components, has recently been introduced



by the W. S. Tyler Co. As an added economy feature, Tyler supplies the line without supporting bases.

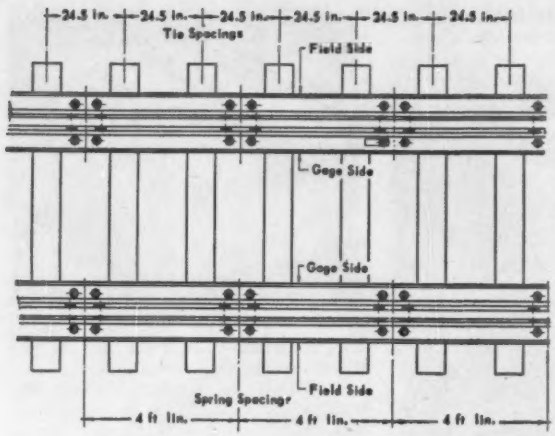
Ty-Rocket is vibrated by an off-balance shaft, supported in two bearings, which gives a high-speed, circle-throw motion to the screening surface. Four universal brackets, described by Tyler as a unique feature, permits simple attachment of either supporting feet with spring mounts, or overhead cables with spring mounts for suspension mounting. The universal brackets also permit adjustment of the screening surface pitch angle. **Booth 227**

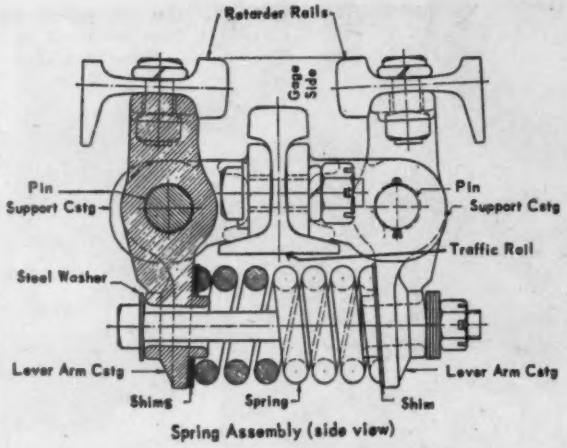
Versatile Drill Rig (53)

INGERSOLL-RAND'S new Crawlmaster, which has a separate portable compressor so that the drilling rig is lighter and more maneuverable, will be shown at the company's booth at Las Vegas.

I-R said that with Crawlmaster, the driller can meet virtually any requirement in the 4- to 6½-in. range, in both hard and soft formations.

Easily interchangeable drills and rotation unit can be mounted on the tower for percussion, rotary or Downhole drilling, as dictated by the individual job requirements. I-R went on to say that flexibility of tower positioning makes the Crawlmaster equally suitable for vertical, horizontal or angular holes. **Booths 506, 510**





Spring Assembly (side view)

Automatic, Mechanical Car Retarder is Adjusted, Then Forgotten (1)

A FEW MONTHS AGO, New Products Digest described Westinghouse Air Brake Co.'s electro-magnetic car retarder (E&MJ, May 1960, p 45). Here's another retarder—a new mechanical type made by Railroad Products Div., American Brake Shoe Co.

American's RACOR mechanical car retarder is installed at the ends of gravity classification yard tracks; and, because it has been designed to bring rolling cars to a stop and to resist further movement by succeeding cars, no skates or skate men are needed.

RACOR consists of spring loaded rails which apply retarding pressure simultaneously to both rim and flange of each pair of wheels.

When a car wheel enters the unit, the retarder rails are forced apart against spring pressure. The company said that the retarding forces are applied to opposite guard faces in such a way as to eliminate the possibility of derailment. Once adjusted, it needs no further attention—operation is completely automatic. **Booth 235**

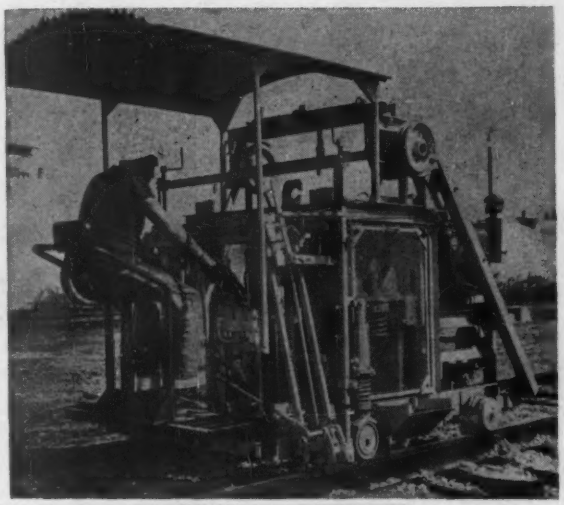
Improved Tamper (32)

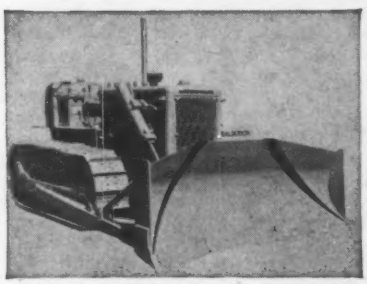
TWO OF NORDBERG MFG. CO.'s latest track machines (one for cleaning track and the other for cribbing) appeared last month on p 41. Here is the third of that series—Nordberg's improved Model "D" tamping power jack.

As with the other two units, the new tamping jack has an all-hydraulic system for moving both itself and all of its parts (raising the head, operating the jacking rams, actuating the rail clamps and for operating the set-off device). Nordberg said that four-wheel braking and hydraulic propulsion have reduced the time between jacking stations and the new hydraulic system needs less maintenance and adjustment.

An adjustable seat and a canopy have been added for operator comfort and efficiency. According to the firm, from the new seated position the operator has a better view of the track and tie being tamped as well as of the pointers and level bubble.

Other Model D improvements include higher horsepower, a pivoted sheave arrangement, improved plastic insulated wheels and larger capacity fuel tank. **Booth 203**





Tractor U-Blades (4)

BALDERSON INC. is now making two U-blade sizes (regular size BD6U-9'6" and large size BD6U-12) for Caterpillar's D6B tractor.

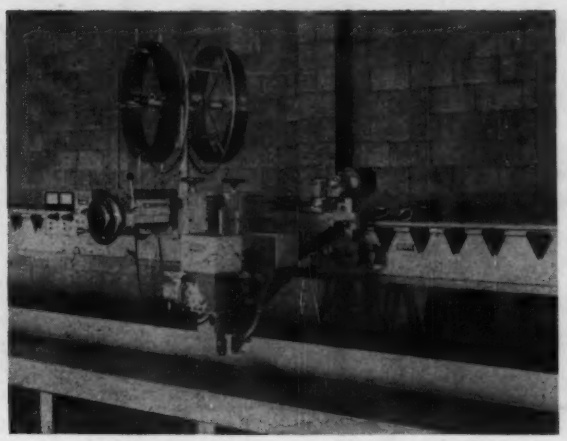
The blades are interchangeable with Cat straight blades on dozers in the field—on new installations, the U-blade uses Cat push arms and braces. The U-shaped design gives greater capacity than the straight or angling blades, resulting in greater production at no increased fuel cost.

Wire Insulation (27)

WIRE INSULATION made from a new type of fluorocarbon resin (Teflon) offers improved resistance to abrasion, plastic flow, cut-through and heat, according to W. L. Gore & Assoc., Inc.

Gore's process consists of adding mineral-fiber particles (about 1 micron wide and 500 to 1,000 microns long) to Teflon. Improved resistance to abrasion and cut-through is the result of orienting more than 90% of the fibers parallel to the wire surface—random orientation would average about 50%.

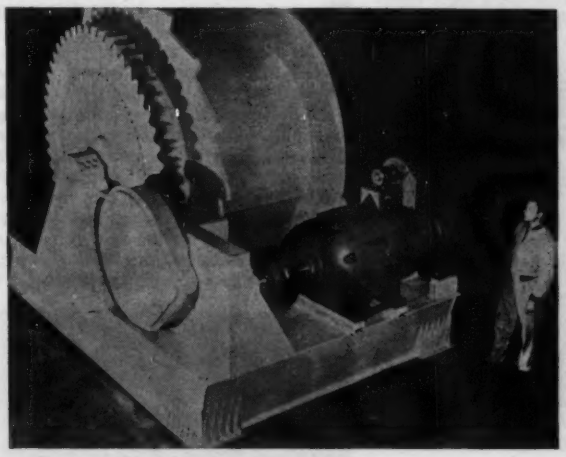
Parallel orientation, the company said, supports concentrated loads and resists penetration of sharp edges. This does away with the need for glass fiber wrapping or braid for surface protection—saves space, reduces weight, and provides insulation.



Track Rebuilder (57)

STOODY CO. is now manufacturing and marketing automatic welding systems in complete package units, including welding heads, power supply and positioning equipment.

The company's track rebuilding machine (see above) uses twin welding heads to rebuild track links and pads of both standard tractors and huge shovels. **Booths 202, 206**



Huge Winch (31)

ULTRA HEAVY-DUTY, single drum electric winch capable of developing more pull than that produced by four standard 1,200-hp railroad locomotives, has been designed and built by R. G. LeTourneau Inc.

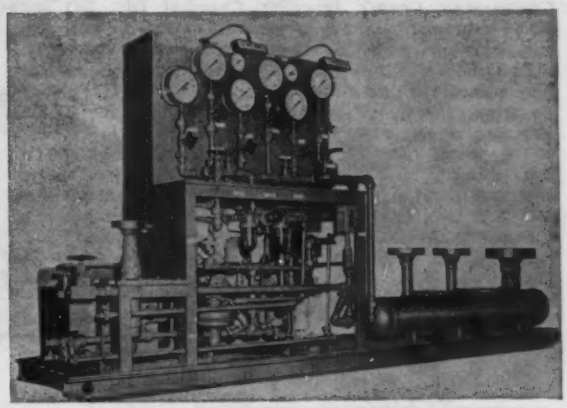
The 10x17x12-ft winch develops 300,000 lb line pull and is capable of holding 900,000 lb without slippage. LeTourneau also said that it has a 7-ft dia cable drum which holds 3,000 ft of 2¾-in. dia wire rope.

An automatic, solenoid-operated brake which engages a brake drum on the motor shaft is the company's assurance of normal operating safety. The brake releases when the motor is energized through the control switch and engages when the control switch is opened or in the event of an electrical power failure. **Booths 3, 5, 639**

Compact Test Stand (38)

FARRIS ENGINEERING CORP. is manufacturing a test stand which they say meets ASME requirements but costs two-thirds less than built-in-plant units. The unit will test all valves including globe, gate, plug cocks, safety and relief plus other hydraulic-pneumatic equipment.

According to the manufacturer, the Universal test stand completely eliminates expensive, time-consuming outside valve maintenance and related shipping costs. Valve inventory can be reduced to a minimum, Farris says, by using the test



stand to reset valves to use them in the widest possible variety of applications and pressure variations.

The test stand is easy to operate—requires no special skill or training. All controls are within reach on one panel with simple instructions printed on a metal plate. The device is compact (10.5 x 3 ft) yet its wide range permits testing of pressure settings up to 2,000 psi for air and 6,000 psi for water. **Booth 618**

Crusher Lubricator (59)

"PROTECTO-LUBE" is a self-contained lubricating unit that furnishes predetermined quantities of oil, under adjustable pressure and temperature, to an oil circulating system and reconditions the lubricant returned to it by filtering before re-use.

Though initially made by Nordberg Mfg. Co. for its Symons cone crushers, "Protecto-Lube" system can be used on other types of crushing and processing equipment. The skid-mounted system, available with new units, can also be adapted to older units.

Symons "Protecto-Lube" is built in capacity ranges from 20 to 70 gpm average oil flow, with provision for varying output above or below these figures, based on 400 Saybolt Seconds Universal lube oil at 100°F and 50 lb per sq in. pump outlet pressure. **Booth 203**

Reduced Port Sleeve (63)

RED JACKET CO. INC. is introducing valves with reduced port sleeves which it says will give a more streamlined material-flow pattern—particularly important with slurries because of abrasion and corrosion. The company said that the extra cost of the sleeve would pay for itself in a short period of time. **Booth 121**

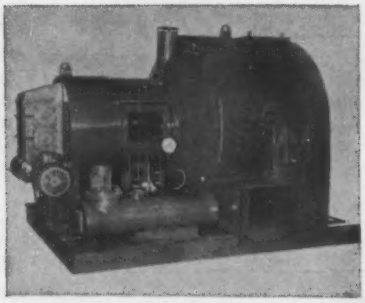
Primer-Initiator (28)

CHROMALLOY CORP.'s Propellex Chemical Div. has introduced a new primer-initiator which it claims is safer, surer, and more economical than dynamite primers.

Designed specifically for ammonium nitrate-fuel oil blasting agents, the Saf-T-Boost Initiator (Model 151) requires no tying, splicing or taping, and is suitable for decking, stemming or any other blasting technique.

The primer (plus 29 lb of ammonium nitrate-oil mixture) can replace a 30-lb dynamite primer for less than half the cost, with equal or better results. In addition to being cheaper and safer than other primers the Saf-T-Boost Initiator is not troubled by hypersensitivity at freezing temperatures.

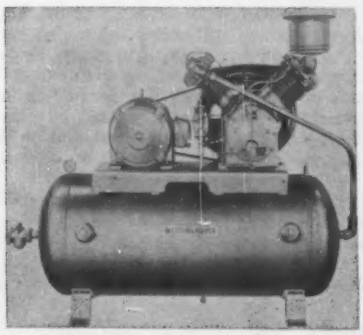
Saf-T-Boost weighs only 13 oz, and is 3-in. wide by 2-in. high. Two ¼-in. holes through the primer permit quick and easy threading of the initiating cord. **Booth 811**



Vibratory Centrifuge (18)

EXCLUSIVE NORTH AND CENTRAL AMERICA manufacturing and sales rights for the Siebtechnik Vibratory Centrifuge (developed and tested in Germany) have been granted to WEMCO Div., Western Machinery Co.

Siebtechnik's separating element is a truncated-cone-shaped screen, whirled at high speed. Solids to be dewatered are introduced through a revolving feeder head, where they are gradually accelerated and directionalized so that they are placed on the revolving screen at its smallest diameter with minimum impact. Solids are kept on the screen, while liquid is effectively removed through it by centrifugal force. **Booths 335, 434**

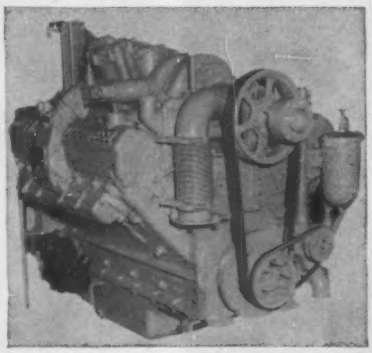


Unit-type Compressor (6)

ALL-NEW UNLOADING SYSTEM for automatic loadless starting has been incorporated into the model 5YC unit-type compressor by Westinghouse Air Brake Co.'s Le Roi Div.

Le Roi has also changed 5YC's inlet valve unloaders for constant speed operation—they have fewer parts than were used in previous assemblies and offer more efficient operation.

Rated operating pressures for the 5YC, using a 10-hp drive, are 125, 175 and 250 psi. The model is also available with a 15-hp drive for 175 psi operation. The compressor has constant speed, start-stop or dual control operation. **Booth 21**



Improved Diesels (22)

TWO ALL-NEW EIGHT-CYLINDER V-type diesel engines will be introduced by Cummins Engine Co. at the AMC Mining Show.

Cummins said that the naturally-aspirated V8-350 and the turbocharged VT8-430 (above) are rated at 350 hp and 430 hp respectively and operate at a governed rotative speed of 2,500 rpm. Each engine's piston displacement is 950 cu in. **Booths 515, 519**

New Sump Pumps (47)

GALIGHER CO. has just introduced two new acid-proof sump pumps—one is a four-in. model and other is six-in. According to the company, both are designed for difficult pumping where heads up to 100 ft and particles up to ¼ in. are encountered. These pumps are enlarged versions of the 1½- and 2½-in. Galigher sump pumps. The pumps have no submerged bearing, no packing and no mechanical seal, and can be used for froths, slurries and most corrosive liquids. **Booth 330**

Long, Narrow Ripper (20)

COMPLETELY REDESIGNED ripper point which is radically longer, narrower and sharper, is being introduced by Electric Steel Foundry Co.

During extensive field tests, according to ESCO, the point tackled material that was previously unrippable and performed from two to ten times longer than other points.

The point's extra length greatly reduces shank wear by breaking ground well ahead of it. This feature coupled with a flat pitch reduces the drawbar load and sometimes allows the tractor to operate in a higher gear. ESCO said that reduced drag will often make possible the addition of extra ripper shanks.

The new ripper point comes in four lengths to match ripping conditions. The shortest point (14 in.) will rip in extremely tough material where other points won't penetrate. The 16-in. point is intended for tough production ripping where it has increased yardage from 20 to 40% over competitive points. The company's 20-in. point will give extremely long service in easily ripped materials. It can increase production by 10 to 20% and will rip 5 to 10 times as long as other points. **Booth 523**

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

HOW A FIRM, without increasing mining operations, boosted its alumina yield by a specialized reclaiming process that extracts the powder from refuse mud, is described in a new bulletin (ER-10-1) from the Fuller Co.

The illustrated, four-page report explains each step in the system that's now being used at Alcoa's Bayer plant, Bauxite, Ark. **(82)**

OHIO GEAR CO. has published a 246-page catalog containing complete information on sizes, ratings and specifications of the company's whole line of gears and speed reducers. It also contains engineering data on the proper selection of gears and reducers to meet specific job requirements.

Ohio said that its 4½ x 6-in. catalog is specially indexed to permit fast, convenient location of specific products. **(83)**

LORAIN 50, a 25-ton, 1-yd crawler mounted shovel-crane, is fully described in a 12-page catalog just released by Thew Shovel Co.

The two-color booklet gives details of construction including Lorain's square - tubular - chord - boom, oil - encased travel mechanism and many other features as well as photographs of the machines in action. **(84)**

"HANDBOOK OF CRUSHING," prepared to provide a better understanding of the entire subject of mechanical size reduction, has just been published by Pennsylvania Crusher Div., Bath Iron Works Corp.

The 40-page book describes and discusses various reduction methods —impact, attrition, shear and pressure. It also outlines the many kinds of crushing equipment. **(85)**

STANDARD OIL CO.'S engineering bulletin No. IT-220 gives a complete survey of fork-lift trucks. With drawings, photos and cutaways, the bulletin describes gasoline-powered engines, LPG-powered engines, diesels, mufflers, engine lubrication, final drives, electric trucks, and operating and maintenance suggestions. **(86)**

VULCAN-DENVER'S new 20-page brochure (AC6002) illustrates and describes a wide variety of its mine and utility hoists.

The booklet includes single-drum and double-drum electric hoists from 1,000 lb to 50,000 lb rope pull, diesel and gasoline engine powered single drum hoists, low speed heavy duty winch hoists and the automation of small hoists at reasonable cost.

Vulcan lists some of the hoists under the minerals with which they're usually associated. **(87)**

"SPROCKETS BY CATERPILLAR" is an eight-page booklet (Form D-025) that explains, according to Caterpillar Tractor Co., "the many features which go into making Caterpillar sprockets last longer." **(88)**

LINK-BELT CO.'S line of belt conveyor idlers has been expanded to include 60 new 35° deep trough idlers and 24 additions to the line of 45° idlers.

According to the company, belt conveyors equipped with the new 35° and 45° idlers offer possibilities for economical handling of materials that formerly needed conventional 20° idlers. Such heavy materials as sand, gravel, crushed stone and certain crushed ores can now be handled with the 35° idlers. The 45° units are primarily designed to handle lighter materials.

A new eight-page booklet, "Deep Trough Belt Conveyor Idlers," lists 12 types of 35° and six types of 45° idlers for belt widths from 24 to 60 in., with steel, rubber cushion and positive action training rolls, equal and unequal length. **(89)**

DESIGN FEATURES, selection data, dimensions, capacities and operating data of Symons primary gyratory crushers are described by Nordberg Mfg. Co. in a four-page, two-color bulletin.

Symons primary gyratory crushers are built in 30-, 42-, 54-, 60- and 72-in. feed opening sizes, for capacities from 250 to over 3,500 tph. **(92)**

"ACCIDENT FACTS," 1960 EDITION, the National Safety Council's

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statistical yearbook, is now available.

The 96-page book contains accident rates by major industry groups, and facts on accident trends and off-the-job accidents—gives a comprehensive background for an industrial safety program. **(90)**

SOLIDS LUBRICATION theory and practice are discussed in a new 24-page, four-color booklet from Alpha-Molykote Corp. (Bulletin 124).

Called "What is Molykote?" the booklet describes the major advantages of molybdenum disulphide solid lubricants—low coefficient of friction, natural affinity for adherence to metal surfaces, and pressure resistance beyond the yield point of the metal.

The company also describes its research facilities and activities and the extensive literature which it has published on the subject of lubrication. **(91)**

SIXTY-TWO OF THE MOST COMMON industrial gas and vapor hazards appears on an industrial gas mask canister selector table put out by Willson Products Div., Ray-O-Vac Co.

Opposite each hazard is listed recommended canister, color guide and Bureau of Mines' approval where applicable. **(93)**

TRACTOR-TREAD LOADERS for high capacity loading of coal, gypsum and potash are described in Goodman Mfg. Co.'s Catalog G-145.

Some of the main features of the 960 Series, according to Goodman, are: four interchangeable motors on each loader for all machine functions; simple, easily accessible electrical controls; smooth, positive hydraulic control for easy handling; gear driven, clutch controlled tramming for fast maneuvering while loading; and 30-in. wide conveyor on both low (24-in.) and high (38-in.) machines. **(94)**

"CONDULETS FOR CORROSIVE LOCATIONS," 20-page Crouse-Hinds Co. bulletin (2699), gives extensive list of corrosive substances and, next to them, the company's appropriate corrosion-resistant metals and finishes.

The booklet also contains brief descriptions of the metals and finishes, and includes listings of Plast-A-Coat condulets for hazardous and non-hazardous locations. **(95)**

CARMET DIV., Allegheny Ludlum Steel Corp., has just issued a 12-page booklet which they say for the first time assembles information that experience and research have produced about the wear resistance and abrasive qualities of cemented carbides.

The presentation gives details on design techniques, various sizes, properties, hardness, abrasion resistance, etc., to help designers select and apply the proper Carmet grade. **(96)**

DORR-OLIVER has revised its 16-page brochure, "Continuous Processing" (Bulletin No. 7004), to illustrate and list the distinguishing characteristics and applications of 55 types of continuous processing equipment made by the company.

Some of the unit operations covered in the bulletin are: agitation, straining, water pretreatment, ion-exchange, industrial waste treatment, drying and dry classification, and roasting and calcining.

The bulletin also describes pilot plant equipment, with special emphasis on classification, centrifuging, filtration and fluidization. **(97)**

BROWNING MFG. CO. is introducing a new line of multiple groove variable pitch sheaves. Some of the outstanding features of the line, as outlined in the company's catalog MVP-101, are: 360° adjustment; concentric grooves, assuring a true running sheave; sheaves are balanced—flanges do not rotate in adjustment; and ground barrels for precision fit. **(98)**

TRACTOR VERSATILITY is clearly shown in a 16-page, beautifully-colored booklet from the Tractor & Implement Div., Ford Motor Co.

Fitted with any one of several different backhoes or with front-end loader, dozer, or back-end lifts, Ford tractors can do almost anything. Outlined applications include heavy and light excavating, heavy and light loading, scraping, leveling and grading, and lifting, towing and general utility. **(99)**

ATLAS VALVE CO. has published a catalog sheet to describe their 1/8-in. and 1/4-in. 3850 Type F pressure reducing and relief valve designed for initial pressures of 4,000 psi with water, oil, air or gas.

Atlas said that the single-seated, spring- loaded, diaphragm- actuated valve has adjustable pressure ranges of 0-1,000, 0-2,000 and 0-3,500 psi and controls pressures within as little as 2-3 lb per sq in. over the entire adjustable range. It is used to supply a process or piece of equipment requiring small capacity or a small unit under test. **(100)**

E&MJ NOT GOOD AFTER MARCH 1, 1961 **SEPTEMBER 1960**

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McGRAW-HILL PUBLISHING COMPANY, INC.

ENGINEERING & MINING JOURNAL

330 WEST 42nd STREET

NEW YORK 36, N. Y.

THERE'S NO EASIER DRILL TO RUN THAN A REICHdrill!

This smooth operating, all-hydraulic rotary rig is helping REICHdrillers set higher footage records

In blast holing, prospecting and coring, there's no easier drill to run than a REICHdrill. And the key to money making drilling records is a simplified *control "console"*. From it, every move required by an experienced driller . . . every decision he makes . . . is converted smoothly, instantly, by the all-hydraulic system, into positive, time-saving performance.

Hydraulic drive to drill stem eliminates power loss . . . transmission troubles . . . kelly and rotary table.

Vari-speed Hydraulic Drill Control gives the operator the right combination of rotary speed and feed pressure for every formation . . . leveling jacks, mast raising cylinder and barrel loader are hydraulic too!

Other features: fast, easy set-ups; mast inclines for angle drilling; CP heavy-duty compressors; CP Air-Blast Bits for extra footage in toughest formation. *You get more from your rotary when it's a* REICH*drill!*

For further information write:

REICHdrill

1442 BEECH ST., TERRE HAUTE, INDIANA

Division: CHICAGO PNEUMATIC TOOL CO.

T-650 truck mounted REICHdrill operating in an Indiana quarry. Hole size: to 7-7/8"; down-pressure: to 30,000 pounds. Other models available, trucks or crawler mounted with hole sizes to 16" down-pressure to 90,000 pounds.

Positioned at control "console", REICHdriller has every rig maneuver in sight . . . every rig control in reach.

KRUPP

We advise

on all projects involving mining of materials and their transportation. We design complete surface and underground mining schemes and the necessary mechanical equipment based on the manifold experiences of our mining, excavation and conveyor engineers.

We design,

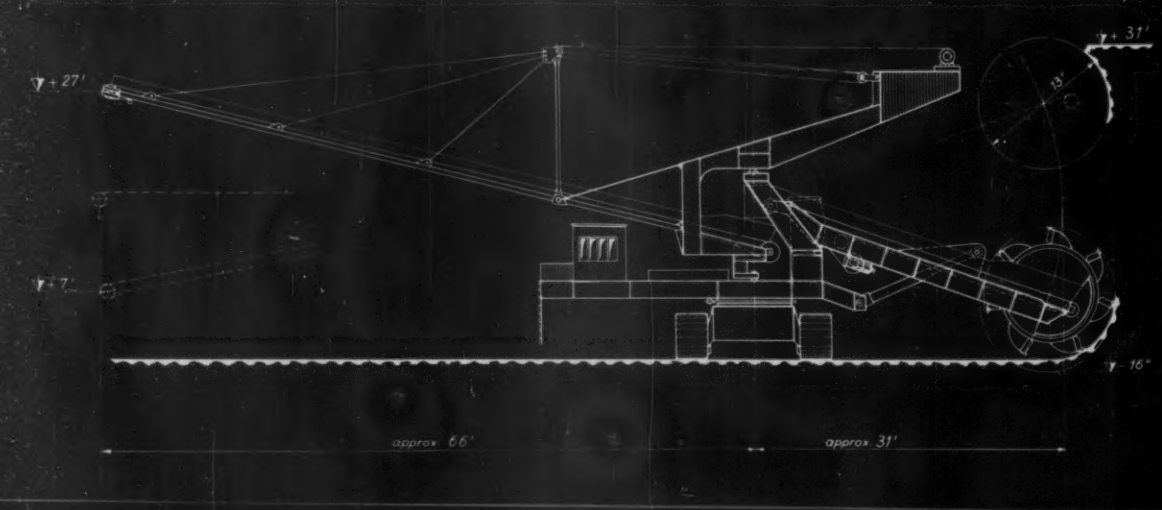
manufacture and erect excavators, either rail or crawler mounted, for mining, canal and dam construction, etc., such as bucket chain excavators, bucket wheel excavators, loaders, spreaders, stackers, special equipment, complete bunkering plants, conveyor bridges, stationary and movable conveyors.

KRUPP Bucket Wheel Excavator Type Sch Rs $\frac{100}{0.4} \times 9.5$
for a theoretical capacity up to 470 cu.yds/hr. Excavator is fully electrified. Bucket wheel boom and loading boom slewable independently.

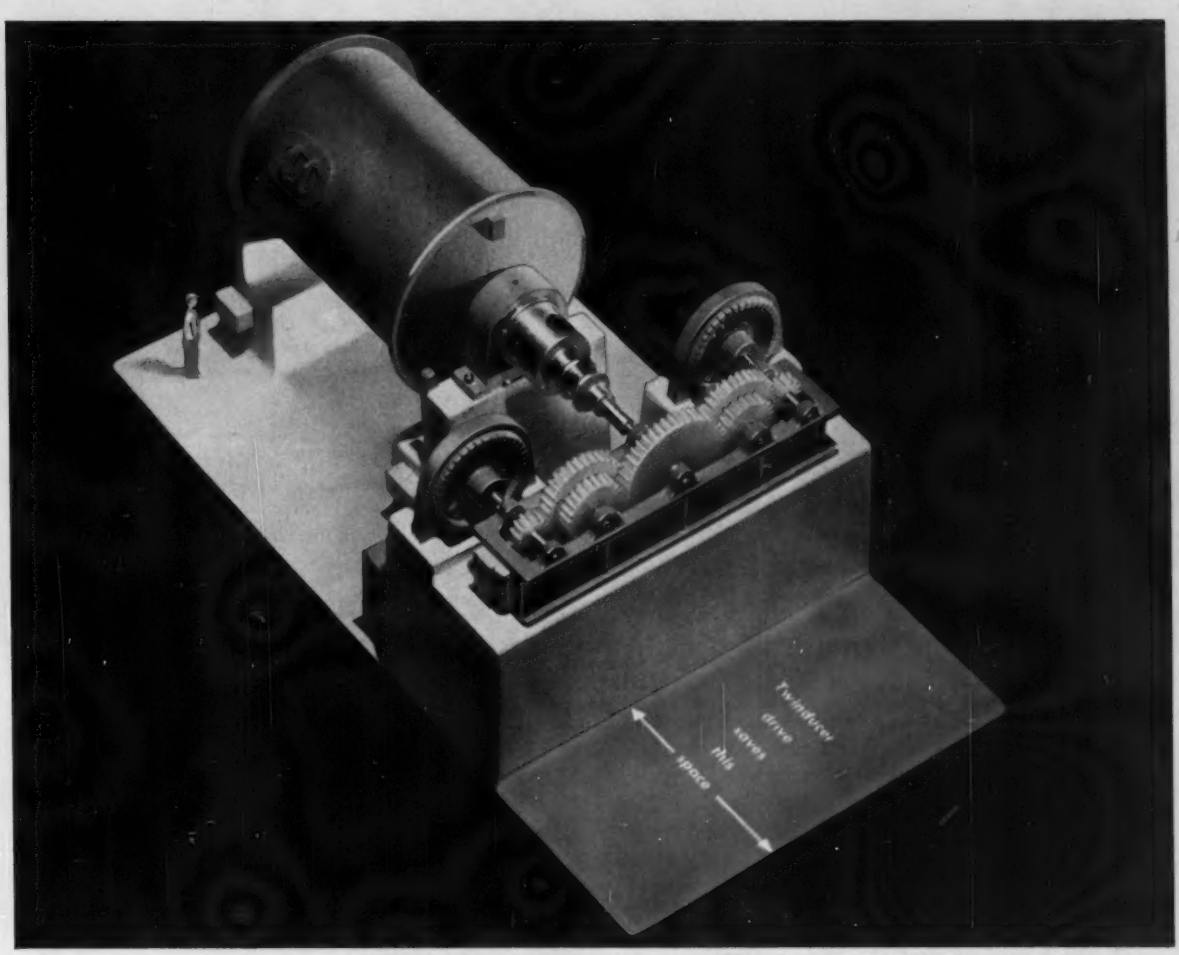
Come and see this bucket wheel at the 1960 Mining Show, held by the American Mining Congress at Las Vegas, Nevada, October 10—13, 1960, on Spaces No. 45, 72, 74, and 76 of the Outside Exhibit Area.

FRIED. KRUPP MASCHINEN- UND STAHLBAU RHEINHAUSEN · GERMANY

For information, please contact Krupp International Inc., 375 Park Avenue, New York 22 N.Y.



ALLIS-CHALMERS



A 2000-hp Twinducer drive mill conserves up to 16 feet of space compared to other trunnion drive designs.

Twinducer drive saves on space and wear...

divides mill loads electrically

Another Allis-Chalmers first — *Twinducer* drive mill — creates new space savings, new long-range operating and maintenance economies.

Dynamic electrical load distribution is accomplished through rotor shift of one of the two motors. Once the load is balanced and the rotor locked in place, there is no need for further adjustment. No need for a floating gear or pinion, either, since electrical, not mechanical, balancing is employed with *Twinducer* drive.

Gears and pinions experience less wear because they are fixed. Wear is further reduced because the gear train runs in a filtered oil bath, promoting longer gear life through both splash and flood lubrication.

Twinducer drive efficiently harnesses the power of *two* synchronous motors located on the mill side of the drive. This unique, compact arrangement reduces drive dimensions drastically . . . as much as 16 feet on a 2000-hp drive.

Twinducer drive promotes better housekeeping, too. No lubricant leakage because the system is enclosed. No oversized foundations, no pits to collect waste materials and dirt.

Ask your A-C representative about the outstanding features of Twinducer drive mills. **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wis.*

Twinducer is an Allis-Chalmers trademark. A-1365

55-ton "Eucs"...21 of them...at new copper mine

At a big open pit copper mine near Tucson, Arizona, a fleet of Model R-55 Rear-Dump Euclids will move over two million tons of waste overburden each month during the mine preparation period. When the property enters the production phase, these "Eucs" will deliver mine ore to the primary crusher in addition to continued operation on the waste haul.

Working around the clock, the haulage units are loaded with 55 tons of waste by big 9-yd. shovels. Hauls to dumping area are about a mile in length. With separate engine and Torqmatic Drive for each rear axle, the Model R-55 has 670 total h.p. Since there is no clutch, changes from one speed range to another are made under full power with no loss of momentum . . . and converter lock-up provides maximum efficient use of engine power on grades and long, high speed hauls.

Euclid's modern rear-dump haulers . . . from the 10-ton Model R-10 to the big R-55 . . . give you a wide range of capacities and models that fit every mine and quarry job. Unmatched field experience, backed by parts and service facilities of a world-wide dealer organization, cuts downtime and pays off in better production. Have a Euclid dealer show you how Euclid's greater dimension can mean lower costs on your work.

EUCLID Division of General Motors, Cleveland 17, Ohio
Euclid (Great Britain) Ltd., Lanarkshire, Scotland

A complete line of rear-dump haulers with payload capacities of 10, 15, 18, 22, 27, 40 and 55 tons.

GM GENERAL MOTORS EUCLID

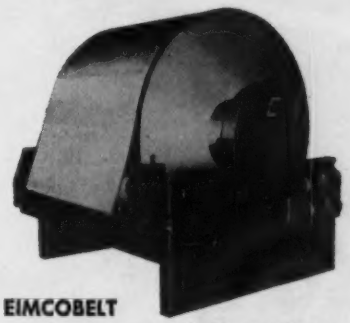
EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

SEE

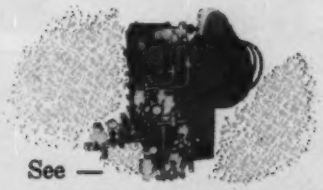
MODERN EIMCO PRODUCTS

at the Mining Show



EIMCOBELT
Continuous Belt Drum Filter

First continuous vacuum filter capable of maintaining a cloth or synthetic fabric filter medium in a constantly unblinded condition.



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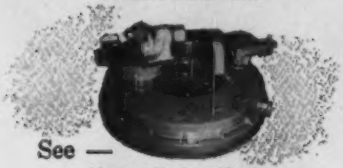

See —
Newest Design Clarifier DRIVEHEAD MECHANISM

FIND OUT . . . How EimcoBelt filter has saved mining companies thousands of dollars a year in freedom from downtime and increased product recovery . . . How Eimco-Burwell filter eliminates high costs in plate and frame filter operation . . . How advanced design and construction of Eimco-Process equipment for clarification results in lower processing costs . . . How Eimco's cooperative engineering approach to equipment problems gives you better results, in liquid-solids separation.

DISCUSS . . . your equipment problems with Eimco specialists. There'll be a staff of experts in the Eimco booth — men who have had years of experience in applying equipment to some of mining's toughest jobs . . . trained engineers who have helped mining men all over the world increase production and profits, with Eimco equipment for filtration, process clarification, water treatment, underground and surface loading, bulldozing.

BOOTH 401

American Mining Congress Exposition
Convention Center, Las Vegas, Nev.
October 10 - 13, 1960

THE EIMCO CORPORATION

FILTER DIVISION
634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

RESEARCH AND DEVELOPMENT CENTER
301 SO. HICKS ROAD, PALATINE, ILLINOIS

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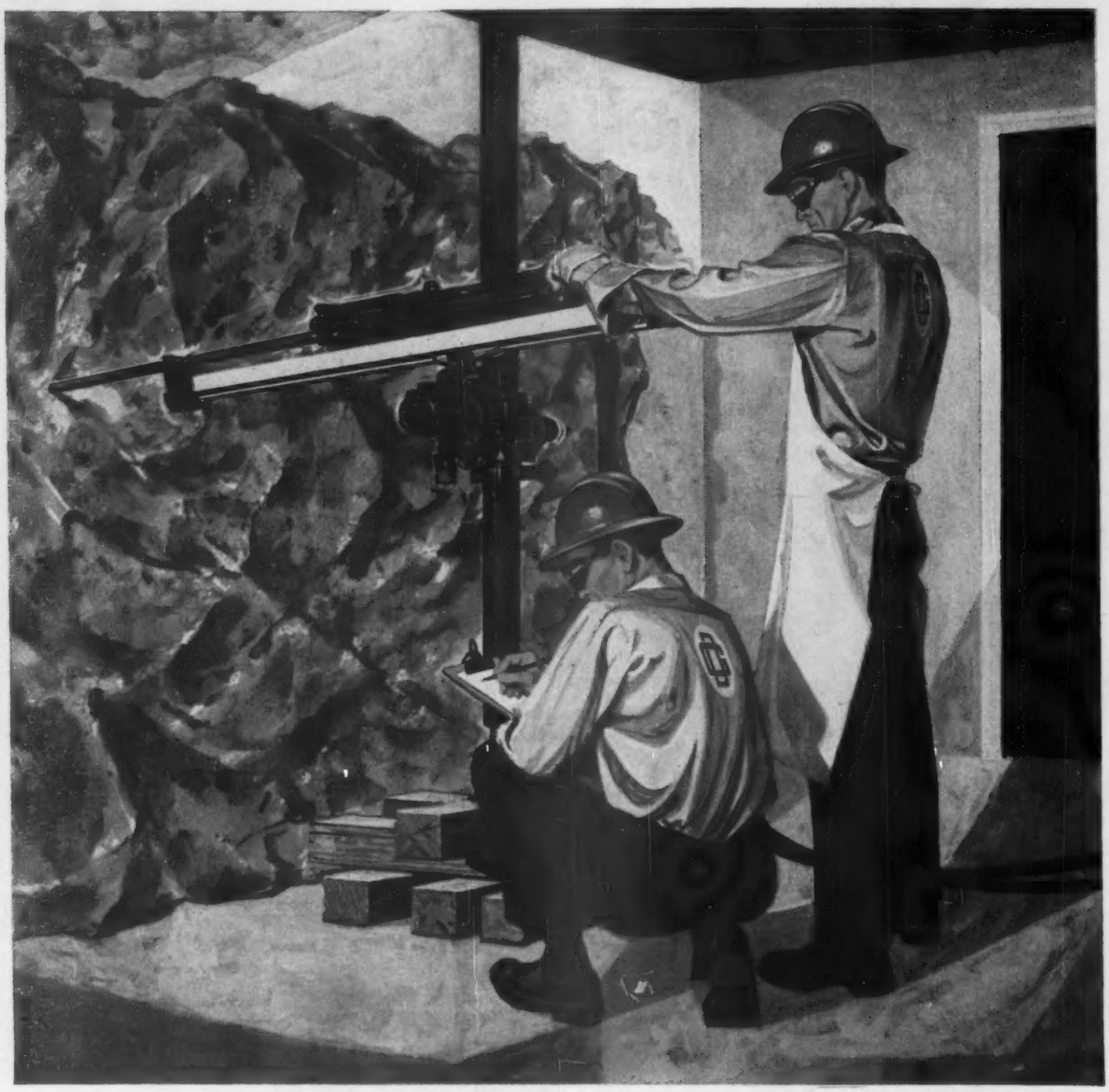
Eimcobelt is a trademark of The Eimco Corporation



"Dress rehearsal" for better drill performance

In this subterranean room of the Denver plant, new Gardner-Denver rock drill models undergo torture tests more grueling than they will ever endure in actual use. Built with watch-like precision, these drills must demonstrate their extra toughness—their superior ability to stay underground, on the job.

But that's only the start. Before a Gardner-Denver rock drill goes on the market, it is thoroughly field-tested in actual mining operations. Then when the drill is sold to a customer, a Gardner-Denver Rock Drill Specialist inspects the drill at work on the site to make sure that it lives up to its promise.

The Gardner-Denver Rock Drill Specialist's chief job is to make *satisfied customers*—not just sales. You'll find it worthwhile to consult him about reducing your rock drilling costs.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

new! improved! The EIMCO® 24 RockerShovel®

From the world's largest and foremost manufacturer of underground rock loading equipment, comes the new Eimco 24 . . . a completely re-engineered, redesigned and greatly improved successor to the famous Eimco 21 RockerShovel, which has been the standard around the world.

NEW

- Greater bucket capacity for faster loading.
- Eimco patented arrangement of bumper springs in arms, with springs enclosed in cylinders.
- Greater stability at discharge.
- Increased bucket cleanup width and digging force.
- Eimco patented replaceable rail design.
- Patented involute rail thrust ends.
- Improved bucket discharge and arm roll down.
- Expanded range of discharge heights.
- Provision for digging below depth of rail.
- Increased discharge distance for better loading of long cars.
- Greater capacity at lower air pressure.
- Write for Bulletin L-1140

first showing

The new, improved Eimco 24 RockerShovel will be shown for the first time at the American Mining Congress Mining Show at Las Vegas, Nevada, October 10 through 13th.

Make sure you visit Booth 401 to see this great machine and other new and better-than-ever Eimco Underground, Tractor, Filter and Process Equipment. Your friends at Eimco will be looking for you!

visit the Eimco exhibit - booth 401 - 1960 mining show

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

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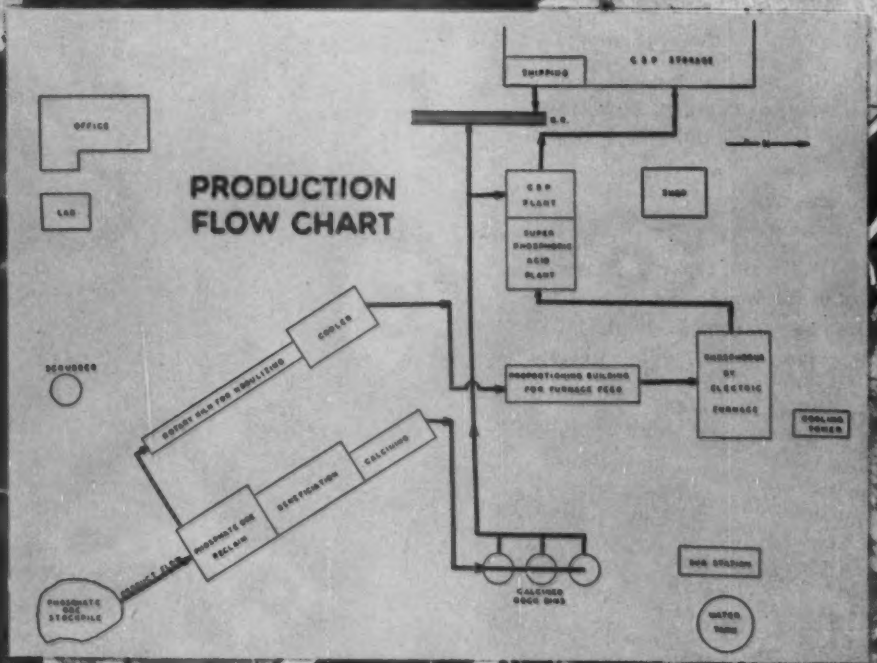
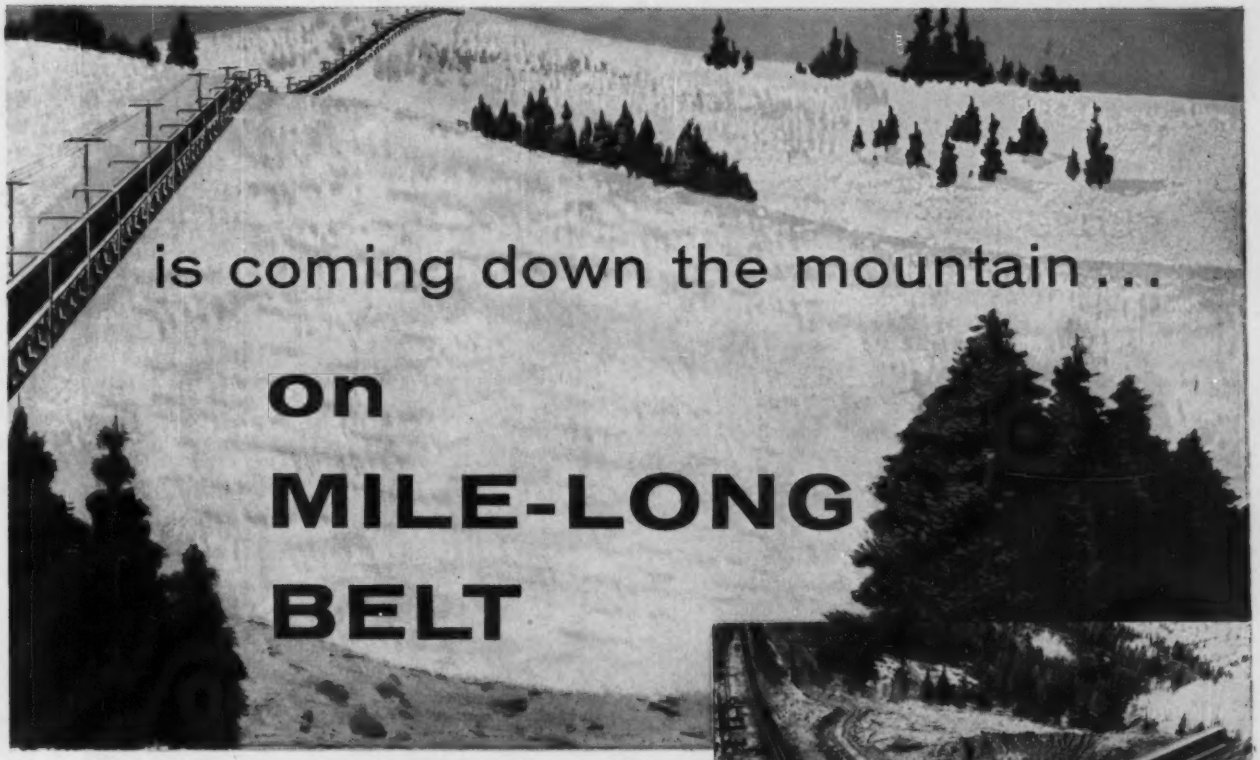
US RUBBER
CONVEYOR BELTS

PHOSPHATE

PRODUCTION FLOW CHART



Raw material crosses canyon on unusual suspension bridge installation. From here it is stock-piled until moved to the plant for processing. Bridge is 900 ft. long.



The Phosphate Works of the Central Farmers Fertilizer Co. (Georgetown, Idaho) produces superphosphorous and high analysis P_2O_5 superphosphate.

"This is a complete U.S. Rubber conveyor belt installation, and a unique engineering feat," says Robert C. Johnson. "The belts do a fine job of conveying the ore down the rugged mountainside to the plant."

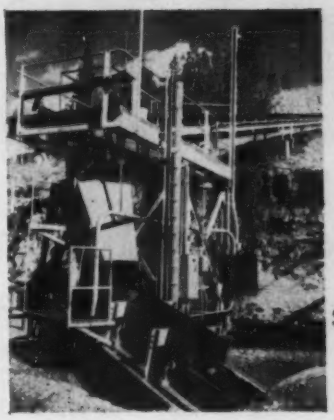
The ore is carried down the mountain from an elevation of 8,200 feet to 7,000 feet, for a distance of more than a mile. The main belt is U.S. Ustex®-nylon, style CX. The use of Ustex-nylon fabric in the 6,400-foot conveyor gives it the toughness and flexibility to transport the ore.

And the ore is stockpiled at the rate of 500 tons per hour!

"The belts have never needed any repairs," Mr. Johnson adds. "It means big savings to our firm."

• • •

The most comprehensive belting engineering information is available through your "U.S." Distributor. It will pay you to check with him.



View from open pit shows belt carrying freshly dug ore on way to processing plant. Conveyor is about 6,400 feet long. Feeder belt in foreground transfers ore to the long belt and large rock onto waste conveyor belt.

Lower end of 6,400-foot conveyor. Ore is dumped onto hopper and leaves at a right angle. From this belt it is dumped onto belt over suspension bridge.

SEE "US" AT BOOTH 1012
American Mining Congress Conv.
Las Vegas, Nevada
OCTOBER 10-13

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

Bethlehem roof bolts clamp rock strata together to improve the safety in this coal mine.

Keeping the roof safe

The proved way to make your roof sound—and keep roof falls to a minimum—is to install bolts in the correct pattern for local conditions. This includes both stratified and massive rock formations.

Who figures this out? Who works right along side your team during the installation? Who checks back, at specified periods, to test and inspect? Your Bethlehem contact man. He'll come see you. Just tell us where and when.

Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
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MOLY ALLOYS MEAN LONGER LIFE WHERE YOU NEED IT MOST

In the mine, in the pit, in the quarry . . . the payoff is at the point of hardest wear. Specify long life molybdenum-containing alloys in your equipment and you immediately cut down the number of shutdowns for part replacement, and increase productivity without boosting capital investment.

You can satisfy just about every high wear rate application with one of the four grades developed by Climax . . .

For gouging abrasion plus impact, **use 12-2 alloy.**

For grinding abrasion, **use chrome-moly steels.**

For scratching abrasion and erosion, **use 15-3 alloy.**

For general purpose abrasion resistance, **depend on 3-2-1 alloy.**

All four have been proved in years of actual mining use. Make sure your equipment benefits by these advanced materials.

Complete details are in "The Role of Molybdenum In Abrasion Resistant Materials", available on letterhead request.
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CLIMAX MOLYBDENUM

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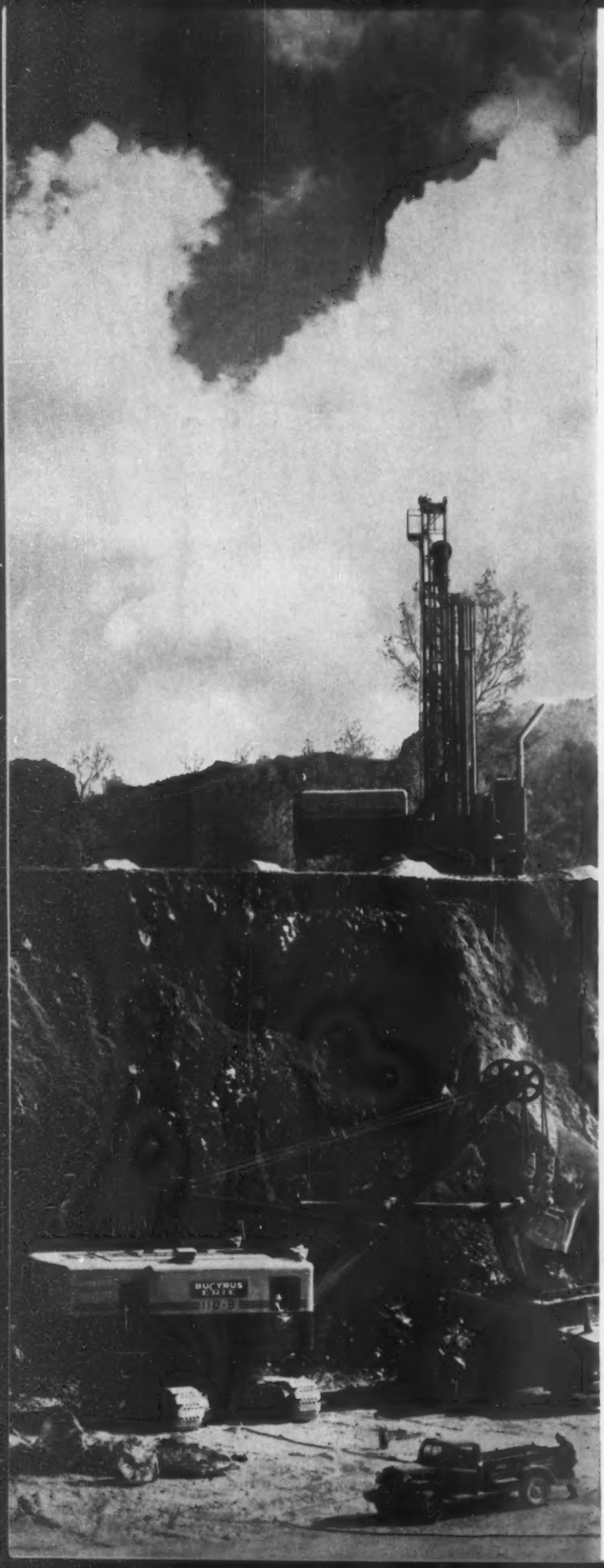
a division of AMERICAN METAL CLIMAX, INC.



A message from

ROBERT G. ALLEN,
President,
Bucyrus-Erie Company

the president of Bucyrus-Erie:

"Here's why you buy a whole system of profitable operation when you buy a Bucyrus-Erie!"

"**Bucyrus-Erie** builds 182 completely different models in the ⅜ to 20-cu-yd class.

Bucyrus-Erie builds cranes and excavators utilizing manual, hydraulic, air and electric controls . . . gas, diesel or electric-powered.

Bucyrus-Erie builds a complete line of draglines from ⅜ to 45 cu yd, many of which can be offered with crawlers or as walkers.

Bucyrus-Erie builds a complete line of stripping shovels from 2½ to 150 cu yd.

Bucyrus-Erie builds a full line of special machines **in addition** to the standard models, including wheel excavators, tower cranes and railroad wrecking cranes.

Bucyrus-Erie builds 25 different blast hole, water, and oil well drills of every type—churn, rotary, down-the-hole, jet-piercing and diamond bit.

Isn't it logical that this is the kind of depth-experience that can best provide you with assistance in building better profits from your operation?"

9160

Robert G. Allen

BUCYRUS-ERIE

Curtiss-Wright CW-226 with Hi-Torque brakes carries heavy loads, averaging 90,000 pounds of earth.

Contractor gets trouble-free performance with Hi-Torque brakes on rough, hilly terrain

Completely dependable brake performance, with high stopping power always available, has been reported by Talbott Construction Company, Winchester, Ky. Talbott operates several Curtiss-Wright earthmovers with B.F.Goodrich Hi-Torque brakes.

On one project, the machines were in operation on rough, hilly terrain over a six months period, ten hours a day, six days a week. No adjustments, replacements, or maintenance of any kind was required. Dust and water are effectively sealed out, so the environment presented no ill effects. Automatic adjusters maintain proper clearance, adjust for lining wear.

B.F.Goodrich Hi-Torque brakes cut stopping distance approximately in half, compared to conventional two-shoe brakes. These brakes are now available on heavy dump trucks, tractor-scrapers, coal haulers, mine trucks, and other heavy off-highway vehicles, from several manufacturers. For information ask your equipment maker, or write *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Department EM-9, Troy, Ohio.*

Hi-Torque brakes permit safe operation on faster cycles.

B.F.Goodrich Hi-Torque brakes

SELECT THE CABLE MADE BY THE FAMOUS "MINE-TO-MARKET" FAMILY...

Phelps Dodge Mining Cable

- Made of highest quality copper from Phelps Dodge's own open-pit mines.
- Combines years of Phelps Dodge mining "know-how" with many years of cable manufacturing experience to give you the finest quality cable you can specify.
- Assures utmost protection against damage from mechanical and electrical hazards in both above and below ground mining operations.
- Listed by the U. S. Bureau of Mines, and approved by the Department of Mines, Commonwealth of Pennsylvania, P-114-BM.

First for Lasting Quality—from Mine to Market!

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TAME THE ROUGHEST, TOUGHEST TERRAIN

with Safety Steel Shield Protection of U.S. Royal Super Fleetmaster!

You know how tire failure can hold up trucks, crews, jobs. Cut down time—get the U. S. Royal Super Fleetmaster. This tire's *Safety Steel Shield* forms a virtually impenetrable barrier against cuts and ruptures. Its *Double-Strength Nylon* is twice as strong as ordinary nylon. This double-armored protection gives you brute strength that defies vicious off-road impacts, yet gives unmatched stamina for long hauls at highway speeds. Call your U. S. Royal Dealer right away!

U.S. ROYAL SAFETY 1ST TRUCK TIRES

United States Rubber

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The earth moving industry looks to

ESCO®

The right design, the right steel, the right shape make *ESCO* Points and Adapters right for every digging condition.

PORTLAND, OREGON and DANVILLE, ILLINOIS

See reverse for shapes and size range

Here are the points to remember...

12M ALLOY STEEL

ESCO 12M Points are the toughest you can buy. Developed through years of research for the construction industry, cast *ESCO* 12M is carefully heat treated to produce the finest steel made for the severe shock and abrasion encountered by points and adapters.

RIGID QUALITY CONTROL TESTS ASSURE TOUGHNESS, HARDNESS

Every *ESCO* Point is Brinell tested to assure the exact degree of shock-absorbing toughness and abrasion-resisting hardness for longer digging life. Be sure to look for the Brinell mark on every *ESCO* Point you buy.

8 POINT SHAPES

You can select from eight different shapes to find the point that matches your digging conditions. *ESCO* Points are designed by bucket and excavation specialists who know how to achieve top digging performance. The self sharpening design of an *ESCO* Point makes it start sharp and stay sharp.

ESCO Points and Adapters for all digging equipment

Your local ESCO dealer can supply Points and Adapters for all your digging needs. By using ESCO Points and Adapters on all your equipment you can cut costs further by reducing your point inventory and consolidating purchases. Call your ESCO dealer today for details. He's listed in the yellow pages of your telephone directory. Or, write direct.

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ESCO Point shapes . . . start sharp, stay sharp and last longer under any digging condition.

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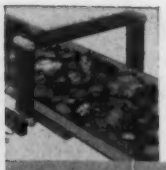
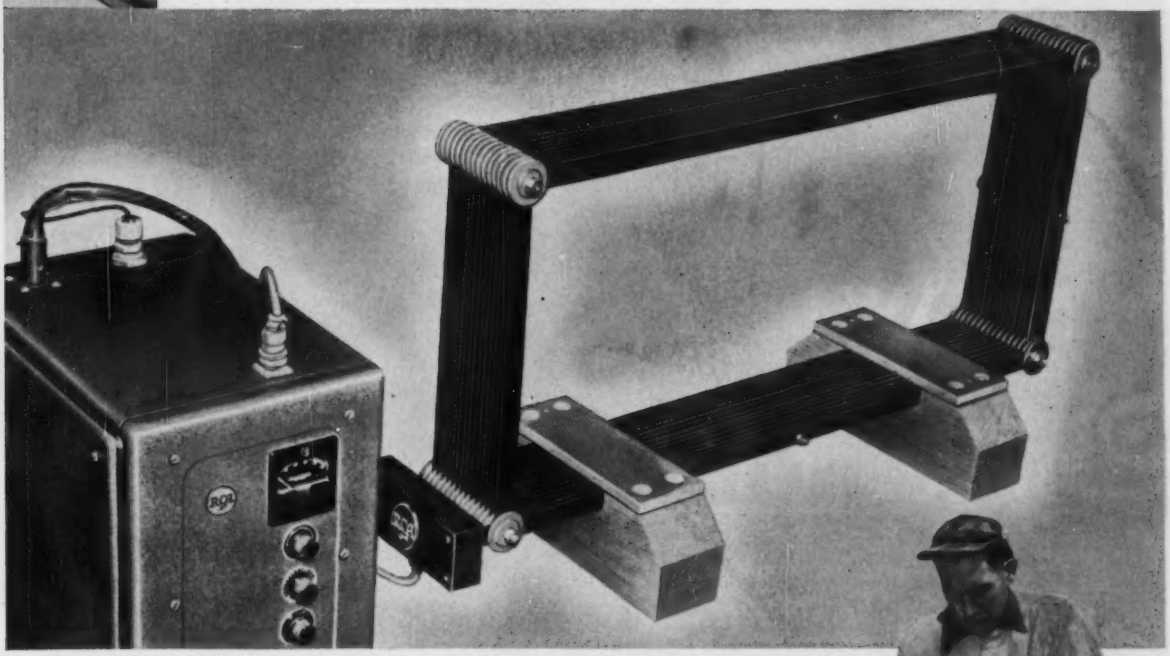


...GATEWAY TO SAFETY FROM TRAMP METAL



New RCA Electronic Metal Detector Designed for The Mining Industry!

The new RCA Metal Detector aperture has been designed for heavy duty service and to withstand the rigors of humidity and moisture encountered in the quarry industry. Rugged components and built-in voltage regulation in the Control Unit provide efficient, trouble-free operation with a minimum of maintenance.

The basic system is made up of an inspection aperture of copper buss bar construction, and control unit. The aperture is available in a wide range of sizes to meet the requirements of various types of installations. Installation is made very simply around the conveyor belt, without need to dismantle the conveyor.

As the material passes through the aperture, the presence of tramp metal causes a signal to be amplified in the Control Unit. This signal is sent to a relay device which controls the motors of the conveyor, warning alarms or other types of rejection mechanisms. The simplified control system can be easily operated by your plant personnel. The RCA Service Company is available to provide supervision of the installation and offers a service contract.

"Detects the trouble that cripples crushers."

Locates tramp metal and sounds alarm. Protects valuable machinery against any metal object.

FREE *literature on the RCA Electronic Metal Detector for quarrying, mining, lumbering operations, will be sent to you without obligation. Write to RCA, Dept. R-236, Building 15-1, Camden, N. J.*

Tmk(s) ®

RADIO CORPORATION of AMERICA

CAMDEN, N. J.

In Canada: RCA VICTOR Company Limited, Montreal

Radio Corporation of America
Dept. L-138, Building 15-1, Camden, N. J.

☐ Rush details on the new RCA Universal Metal Detector.
☐ Have a representative call.

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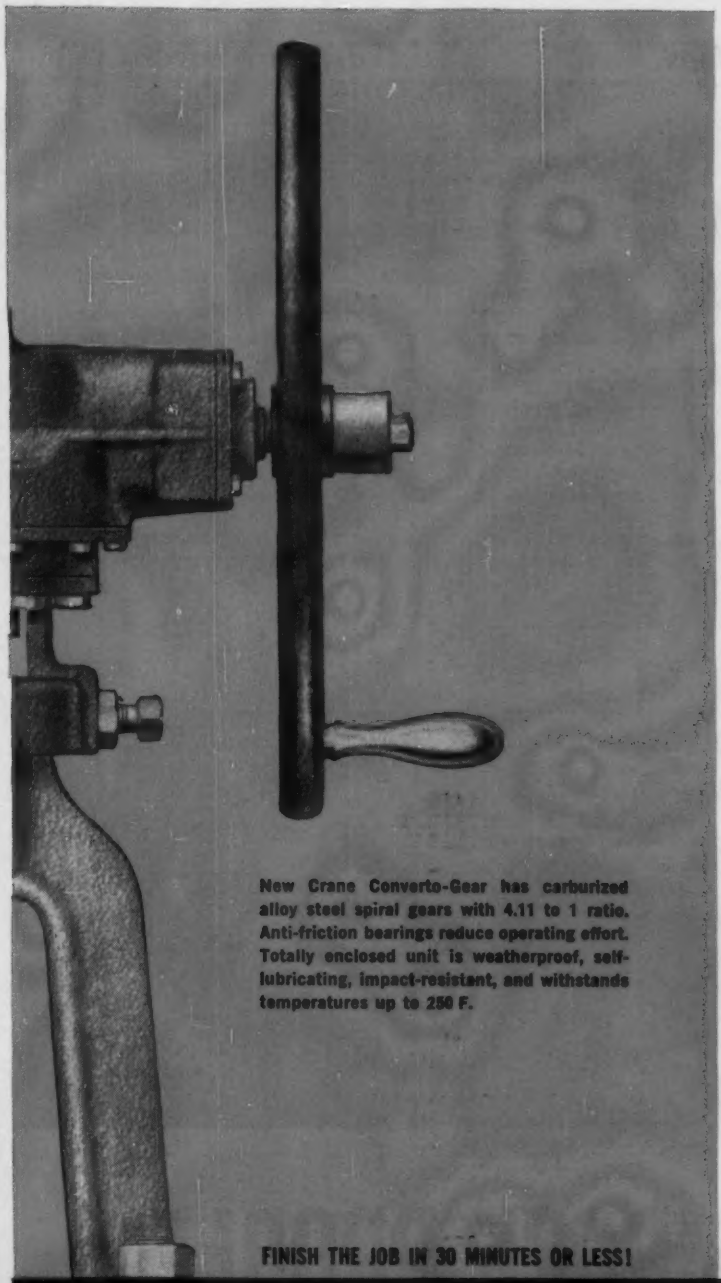
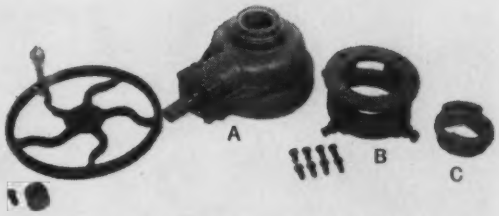
DIRECTION '70

. . . a fast-moving program of planned expansion, product development, and streamlined distribution to help our customers meet the competitive challenges of the Sixties.

NEW! You can order this CRANE Converto-Gear Valve Operator from stock... install it in less than 30 minutes



New Crane Converto-Gear has carburized alloy steel spiral gears with 4.11 to 1 ratio. Anti-friction bearings reduce operating effort. Totally enclosed unit is weatherproof, self-lubricating, impact-resistant, and withstands temperatures up to 250 F.



Only three parts needed to convert your OS & Y valve to gear operation: (a) Crane Converto-Gear Operator, (b) adapter for mounting operator on valve, (c) yoke sleeve adapter. Handwheel and mounting bolts furnished with conversion kit.

Now you can convert to rapid, easy gear operation on many of your Crane iron and steel gate valves without removing them from the line! Changeover is simple and fast with Crane's new Converto-Gear Operator.

Your Crane Distributor can give you complete information on this brand-new idea in gear operators for gate valves. The Converto-Gear is standard and universal, readily mounted on Crane iron and steel gate valves in sizes from 6-inch to 36-inch, in outside screw and yoke or non-rising stem patterns.

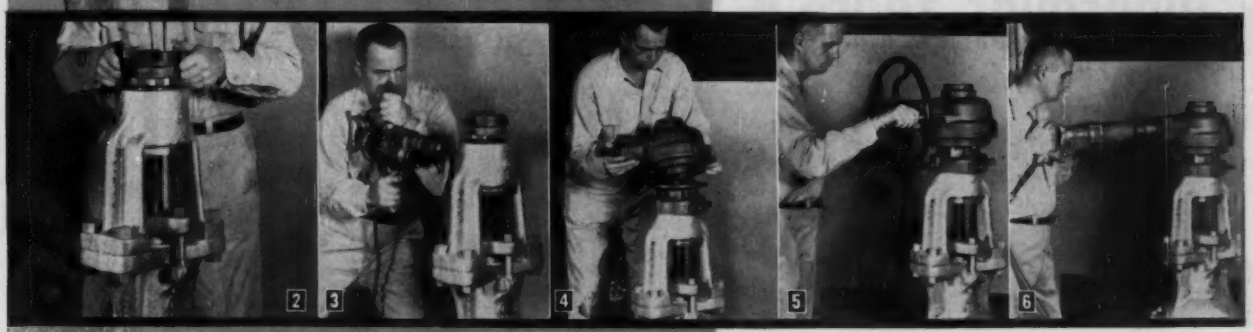
And new orders for gear operated valves can be filled with unprecedented speed because the Converto-Gear can be supplied on valves right from stock. No special yoke castings or brackets are needed . . . just the basic gear operator and a simple two-piece adapter.

CRANE®

CRANE CO., INDUSTRIAL PRODUCTS GROUP
4100 S. KEDZIE AVE., CHICAGO 32

VALVES • ELECTRONIC CONTROLS • PIPING
PLUMBING • HEATING • AIR CONDITIONING
HEAT EXCHANGERS • CYCLOTHERM® BOILERS

FINISH THE JOB IN 30 MINUTES OR LESS!



To convert your OS & Y valve, (1) remove the handwheel, (2) mount the yoke sleeve adapter, (3) countersink 4 holes for the Converto-Gear adapter, (4) bolt the adapter in place and attach your Crane Converto-Gear Operator, (5) and you're ready for smooth, manual operation, (6) or fast operation with an air or electric power operator.

sinkers

CP-69 Sinker Drill. This new, fast drilling, heavy-duty 55-pound class Sinker has "Beavertail" retainer for extra durability. All-purpose backhead permits Blower Dry, Wet and Air-Water operation. Air consumption and maintenance are low.

airlegs

Attachable or Integral Airleg Mountings set up fast! Give high drilling efficiency with hard-hitting CP Sinkers and tungsten-carbide bits. Closely held feed pressures insure full bit contact for maximum footage. Single or double telescopic feed available.

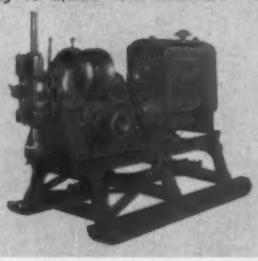
demos

The streamlined CP-124 Demo is the newest in a great line of smooth-handling demolition tools. Has shock-proof latch-type retainer and 4-bolt backhead. This all-new 80-lb. class demo packs more smashing power per pound than any other demo on the market.

core drills

CP post-mounted Core Drills cut costs for: blastholing, foundation sampling, grout-holing, weep holes. The new CP-65 Diamond Drill — world's fastest — delivers 20% more power than its predecessor, the world-famous CP-55. Capacity: 600 feet with EX Fittings.

Versatile skid-mounted Core Drills may also be truck mounted. Gasoline, diesel, air or electric drive. Capacity to 2,250 feet with EX Fittings.

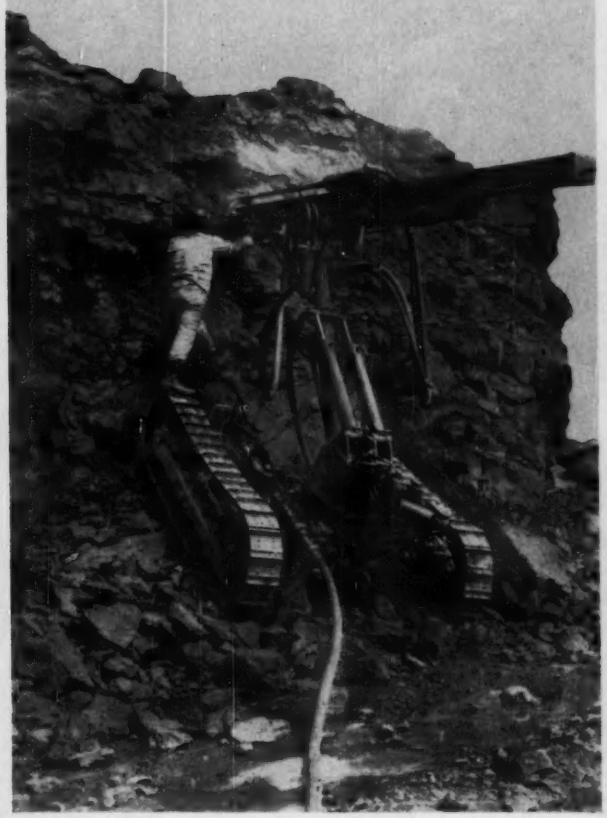


Skid-mounted Core Drill

wherever there's a ROCK PROBLEM there's a CP ROCK DRILL TO LICK IT!

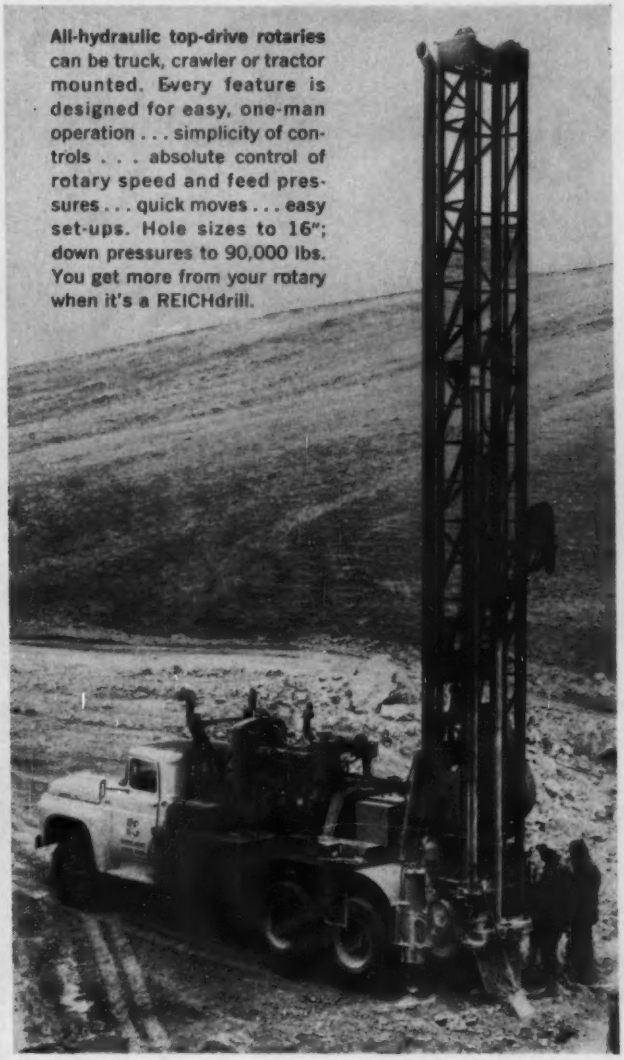
Tracdrils

All-new G-900 Tracdril for 4" and 4½" Deep-Hole Drills The only rig that can drill at right angles to tracks on either side . . . a full 180° swing. Drills extra-low snake holes or hard, high horizontals 11 feet overhead. Extra long tracks and knee action increase pulling power and stability. Automatic brakes and "dead man" tramming controls insure operator safety. Dual operating controls at boom end and turret save steps, increase throttle time.



REICHdrills

All-hydraulic top-drive rotaries can be truck, crawler or tractor mounted. Every feature is designed for easy, one-man operation . . . simplicity of controls . . . absolute control of rotary speed and feed pressures . . . quick moves . . . easy set-ups. Hole sizes to 16"; down pressures to 90,000 lbs. You get more from your rotary when it's a REICHdrill.



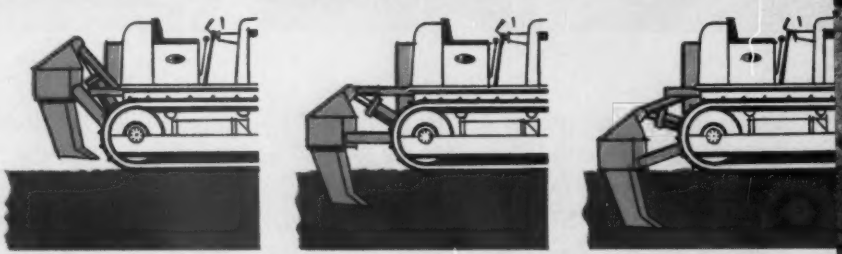
You'll find project-proved CP ROCK DRILLS setting footage records in every kind of formation. For EXPLORATION to see what you're up against . . . for BLAST HOLE DRILLING under every conceivable condition . . . for SECONDARY BREAKING or DEMOLITION – your quickest way to lick the problem is to start with the right equipment and the *right equipment* is CP.

To get up-to-date information on any specific Rock Drill shown here, write for the latest bulletin to: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

AIR COMPRESSORS • PNEUMATIC AND ELECTRIC TOOLS • AIR-BLAST BITS • DIAMOND DRILLS • REICHdrills • ROCK DRILLS

The unique parallelogram design of Allis-Chalmers rippers keeps shanks at the most effective angle . . . up . . . halfway down . . . down full depth.



TOUGH TOOLS MATCH TOUGH JOB POWER

Allis-Chalmers rear-mounted rippers maintain most effective penetration angle at all depths . . . up front, specially designed bulldozers make most of HD-21's tremendous power.

Modern tractor power, *plus* modern ripper and dozer design, is making a big difference on today's tough jobs. With the HD-21 and ripper, for instance, up to 60,000 pounds of drawbar pull let you rip 'n' doze what you once shot and shoveled . . . puts one man, one modern machine in place of a typical 4-man blasting operation.

Allis-Chalmers leads the field in making rippers practical and effective for these tough jobs. The introduction of *parallelogram design* — unique Allis-Chalmers feature on these big HD-21 rippers — keeps shanks at most effective penetration angle *at all depths.* You get the *same* effective tooth angle *. . . up . . . halfway down . . . or working a full two feet deep!*

In addition, Allis-Chalmers dozer design utilizes the latest developments in steel to produce durability which makes the most of today's big tractor power without profit-killing maintenance and repair. Trunnions, "C" frames, struts and moldboards match the HD-21's brute strength. If you're bidding or working *any* tough materials, your Allis-Chalmers dealer will furnish all the facts on successful ripper/dozer application. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

move ahead with

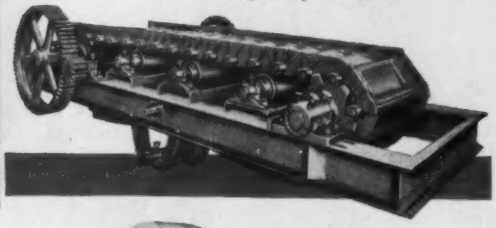
ALLIS-CHALMERS

power for a growing world

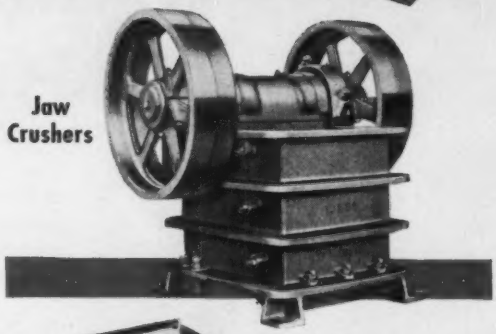
TELSMITH

feeding
coarse crushing
screening
fine crushing
scrubbing

EQUIPMENT
FOR MINES

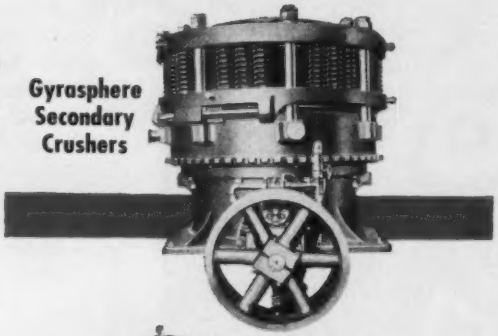


Heavy-Duty Feeders

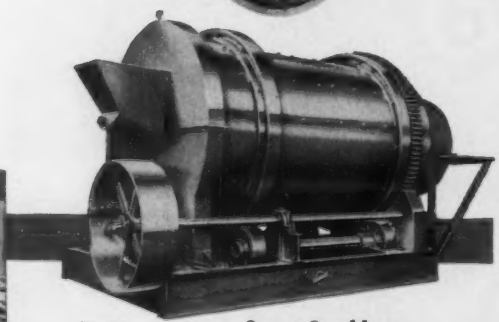


Jaw Crushers

Vibrating Screens



Gyrasphere Secondary Crushers



Mln. 36 Super-Scrubbers

SMITH ENGINEERING WORKS
502 E. CAPITOL DRIVE, MILWAUKEE 1, WISCONSIN

A DIVISION OF
Barber-Greene
Aurora, Illinois, U.S.A.

Cable Address: Songworks, Milwaukee • **Representatives in Principal Cities in all Parts of the World**

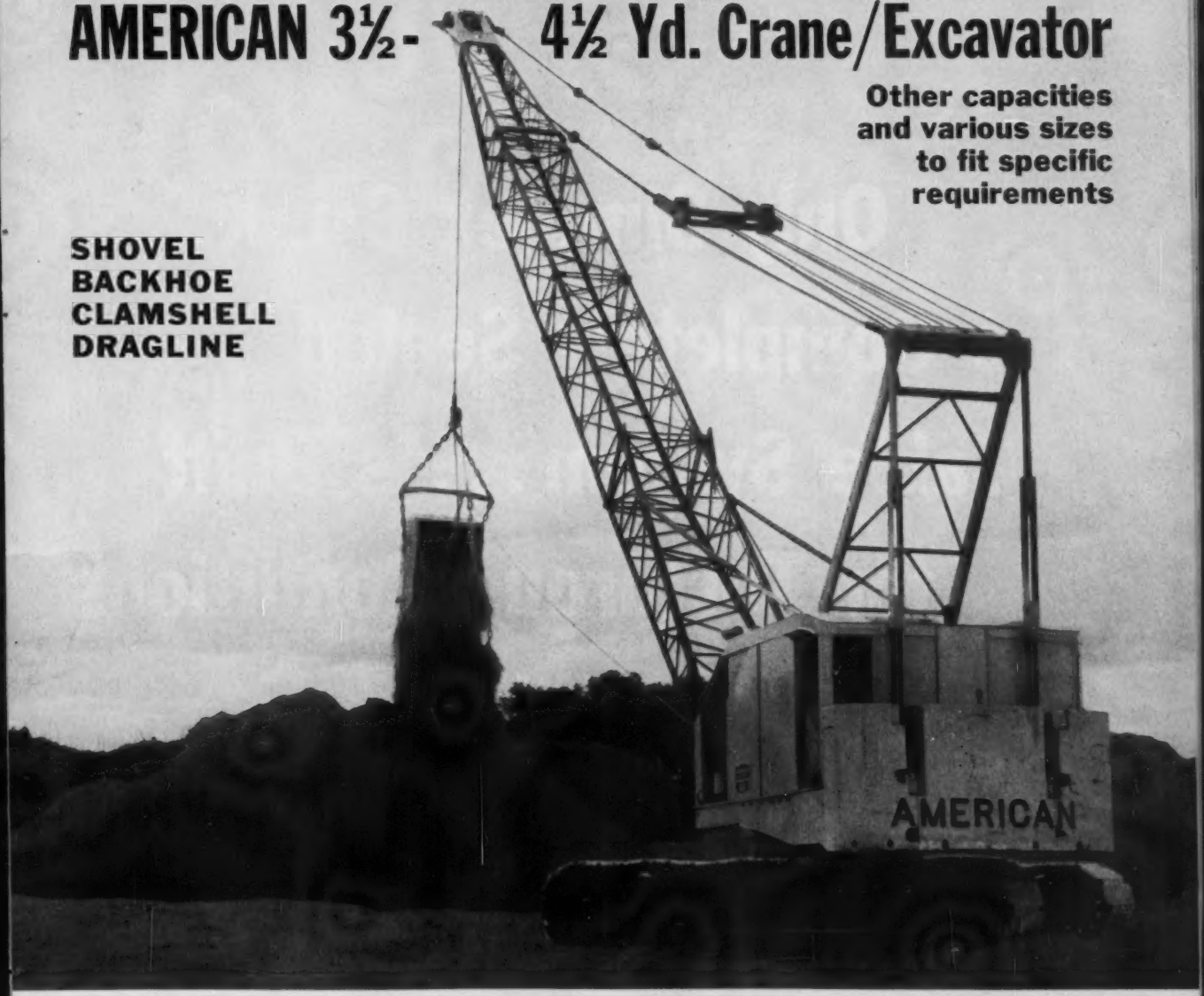
New! Exclusive In Its Class!

FOR TOUGHER, FASTER MINING OPERATIONS

AMERICAN 3½- 4½ Yd. Crane/Excavator

Other capacities and various sizes to fit specific requirements

SHOVEL
BACKHOE
CLAMSHELL
DRAGLINE



New AMERICAN "900" SERIES Dragline with 100-foot Boom and 4-yard Bucket.

ENGINEERED FROM GROUND TO BOOM TIP TO WITHSTAND SEVEREST SHOCK AND STRAIN . . . Full 18" Ground Clearance! . . .
3 Crane Booms . . . up to 270 Ft. in length! . . .
Most rugged Machinery Deck in its class!

Get all the high volume—low maintenance facts on the industry's newest Crane/Excavator now!! See your American Distributor or contact us direct with the coupon.

American builds 'em better . . . so you can finish faster.

AMERICAN HOIST
and Derrick Company
St. Paul 7, Minnesota

PLEASE SEND ME ALL THE FACTS AND FIGURES ON AMERICAN'S BIG "900"

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Company
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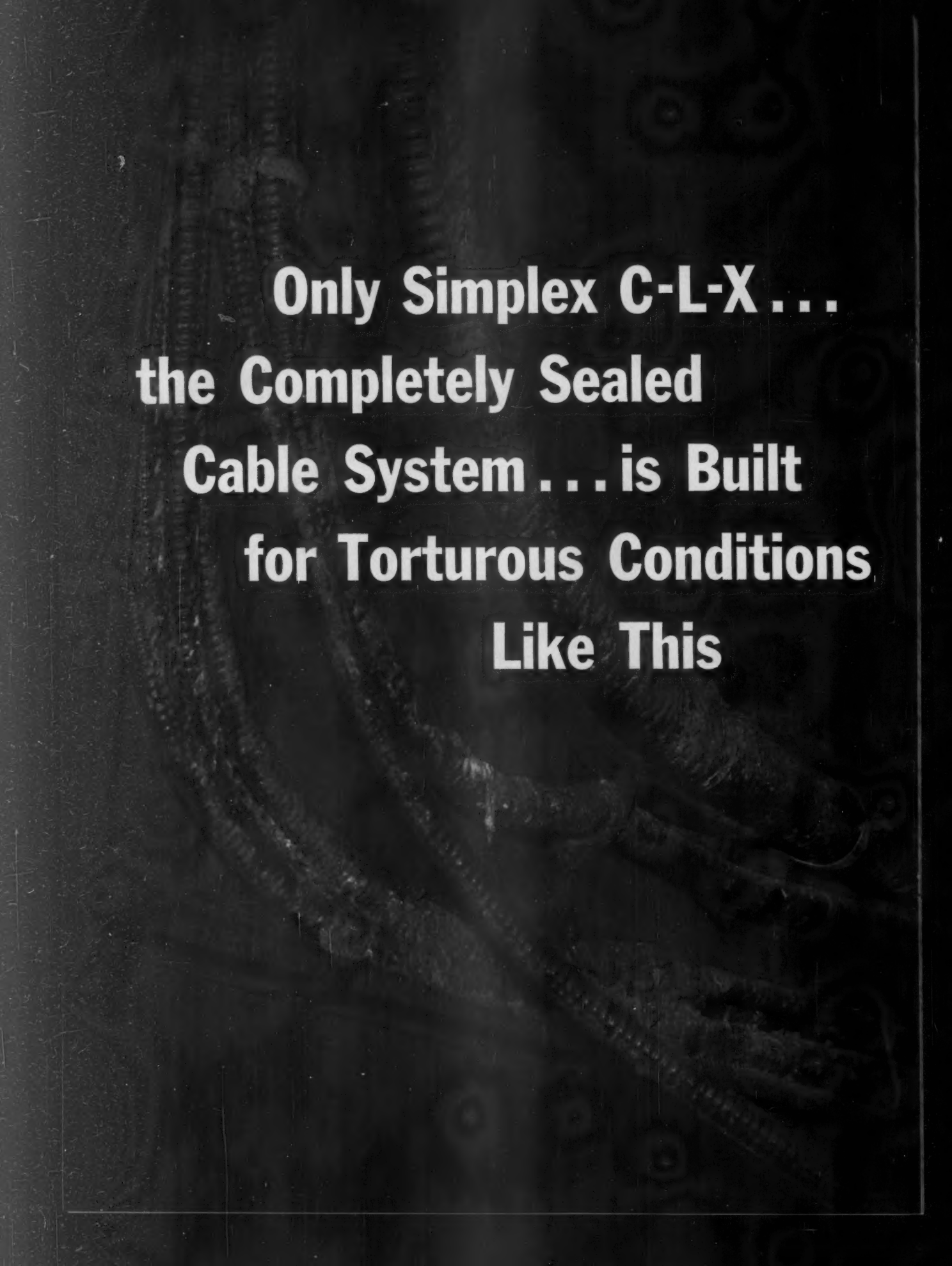
MAIL TO:
AMERICAN HOIST AND DERRICK CO.
ST. PAUL 7, MINNESOTA


Only Simplex C-L-X . . .
the Completely Sealed
Cable System . . . is Built
for Torturous Conditions
Like This

Simplex C-L-X combines cable and duct in one integrated system

Metal, in the form of a continuous flat strip, is formed into a welded tube around the insulated cable. The metal tube is then corrugated to form Simplex C-L-X.

Simplex C-L-X

- Completely sealed to prevent penetration of liquids and gases.
- Protected against mechanical damage by a continuous, corrugated metallic sheath.
- As pliable as unsheathed cable because of its corrugated design.
- Requires no separate duct or conduit in any environment.
- Nonferrous sheaths can be designed to function as grounds or shielding.

The cable you see here is *not* interlocked armor. It is Simplex' new C-L-X . . . the completely sealed cable system.

C-L-X is insulated cable enclosed in a continuous corrugated metallic sheath. It is impervious to liquids and gases, is highly resistant to crushing, cutting and other forms of mechanical damage, and is as pliable as unsheathed cable of the same size and insulating compound.

Simplex C-L-X requires no separate duct or conduit, and can be installed in a continuous run regardless of the number of bends. Available with sheaths of steel, aluminum, copper or bronze, and with or without outer plastic jacketing, Simplex C-L-X provides the ideal solution for almost any installation, particularly those in which cable life is limited by severe ambient conditions.

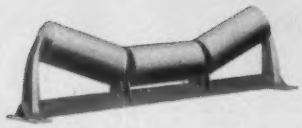
Write today for illustrated brochure containing application and engineering information.

Simplex

WIRE & CABLE CO.

Cambridge, Mass. • Newington, N. H.

SERIES 5000
For intermittent operation . . . relatively low capacity.



SERIES 6000
For continuous operation . . . moderate capacity.

759 ways to solve your idler problems

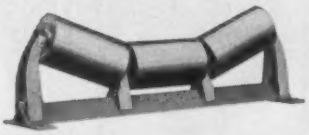
Link-Belt idlers in standard types and sizes to meet every conceivable belt conveyor need

You're sure to find the exact idler to perfectly match your belt conveyor requirements from the complete Link-Belt line of 759 types and sizes.

This broad line enables you to select a size idler that exactly matches your needs, no over- or under-engineering. Power requirements are held to a minimum. In addition, anti-friction bearings, accurate roll alignment and rugged construction provide maximum life for idlers and conveyor belt in light- or heavy-duty service.

Link-Belt idlers are available with end rolls inclined at 20°, 35° and 45° for a broad range of belt widths. Matching lines of troughed belt rubber cushion, troughed belt training, return belt and rubber tread return belt idlers are also available. Call your nearest Link-Belt office or authorized stock-carrying distributor for full details. Look for CONVEYORS in the yellow pages of your phone book. Or write for Book 2716.

SERIES 7000
For continuous operation, higher capacities, heavyweight, abrasive materials.



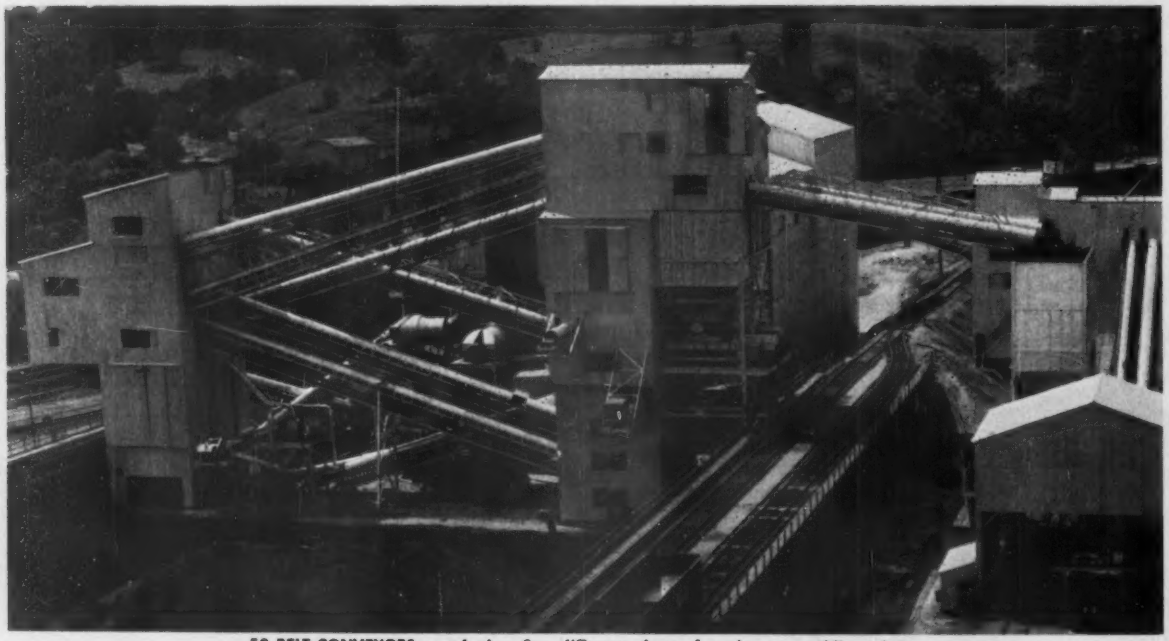
SERIES 8000
For continuous operation, higher capacities, heavier-weight, abrasive materials.

SERIES 9000
For continuous service, highest capacities, heaviest and coarsest materials.

LINK-BELT

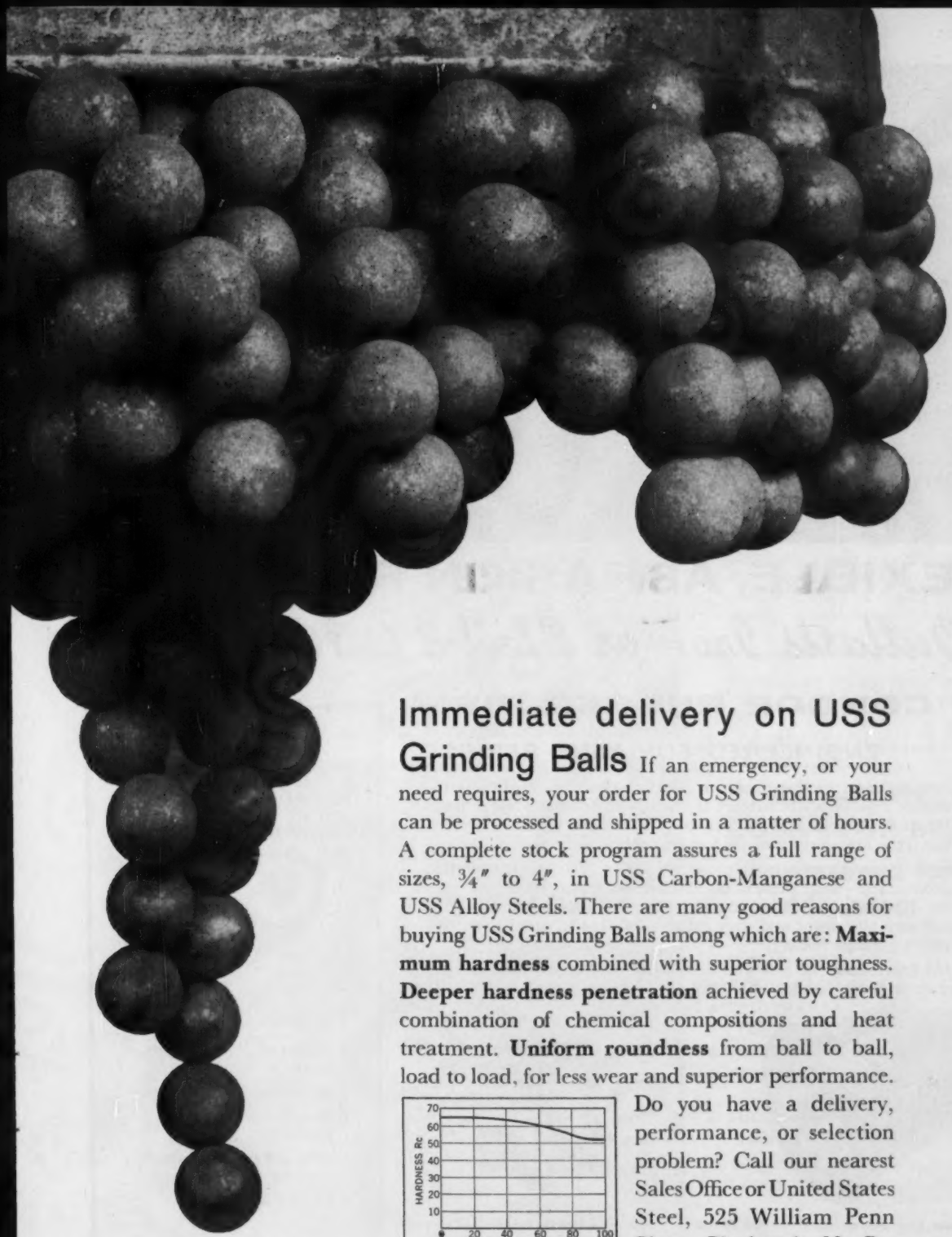
BELT CONVEYOR IDLERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 18,407



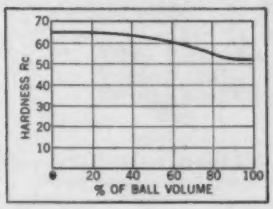
50 BELT CONVEYORS, employing five different sizes of various type idlers, keep raw materials moving steadily through this sintering plant of Armco Steel.

Visit our exhibit, Mining Show, Convention Center, Las Vegas, Nev., Oct. 10-13, Space 215



Immediate delivery on USS Grinding Balls

If an emergency, or your need requires, your order for USS Grinding Balls can be processed and shipped in a matter of hours. A complete stock program assures a full range of sizes, ¾″ to 4″, in USS Carbon-Manganese and USS Alloy Steels. There are many good reasons for buying USS Grinding Balls among which are: **Maximum hardness** combined with superior toughness. **Deeper hardness penetration** achieved by careful combination of chemical compositions and heat treatment. **Uniform roundness** from ball to ball, load to load, for less wear and superior performance.



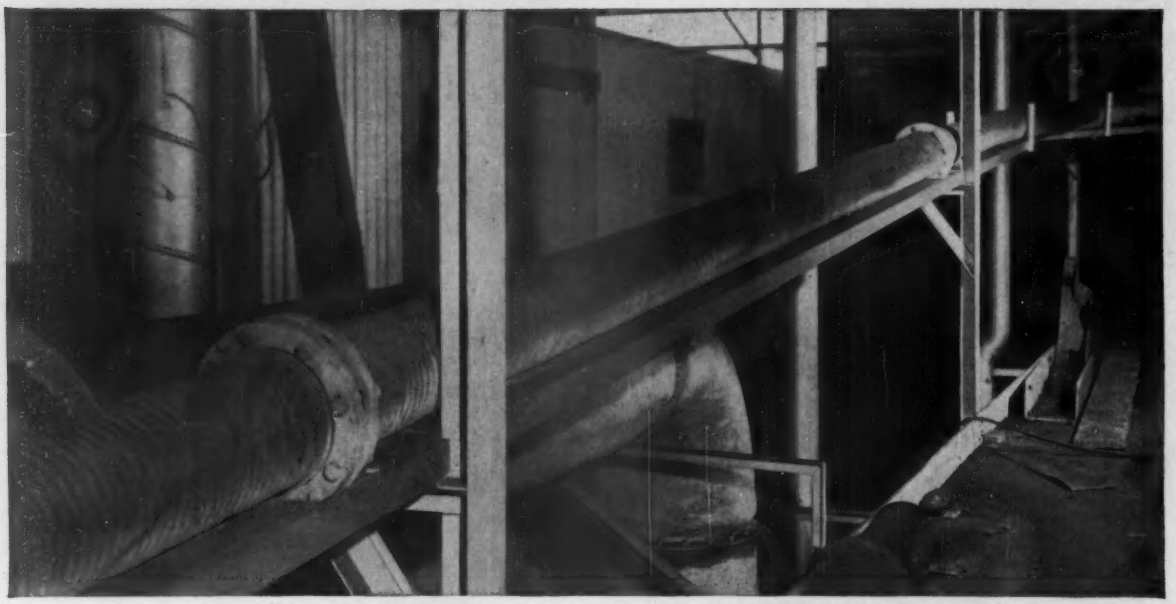
Do you have a delivery, performance, or selection problem? Call our nearest Sales Office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is a registered trademark

This mark tells you a product is made of modern Steel.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company
United States Steel

USS



FLEXIBLE, ABRASION RESISTANT

Outlasts Iron or Steel 3 to 10 Times

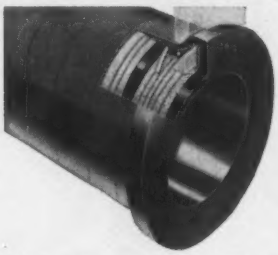
R/M CONDOR RUBBER PIPE

ENGINEERED FOR MINE SERVICE

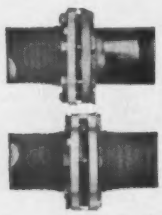
For handling tailings, cinders, slag or flotation feed . . . on dewatering lines—wherever pipe lines are subject to corrosion, abrasion, water hammer or vibration—there's "More Use per Dollar" in Condor Flexible Rubber Pipe. It is extremely flexible, yet strong and light in weight.

It is made in types to withstand pressures up to 250 psi. Installation is easy, economical—and there's no danger of leaky joints at pipe bends. New Hydro-Lok built-on flanges offer full sealing surface *plus* advantage of sure alignment and easy rotation of pipe to equalize wear—*without* removing flange bolts.

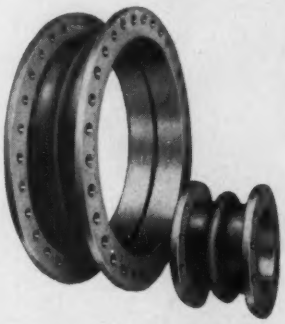
Let an R/M representative give you details on Condor Flexible Rubber Pipe . . . or write today for Bulletin 7152.



- Steel Pressure Ring molded into Hydro-Lok Flange
- Thick, corrosive resistant tube
- Multiple plies of heavy duck
- Reinforcing spiral of steel spring wire
- Tough durable cover



Hydro-Lok Flanges may be used with equal ease to couple rubber pipe to iron pipe with standard flanges (top) or existing sections of rubber pipe using other flanges.



R/M RUBBER EXPANSION JOINTS

- Overcome Pipe Expansion Stress
- Avoid Piping Misalignment
- Resist Abrasion and Corrosion
- Offer Maximum Resistance to Shock
- Require No Gaskets

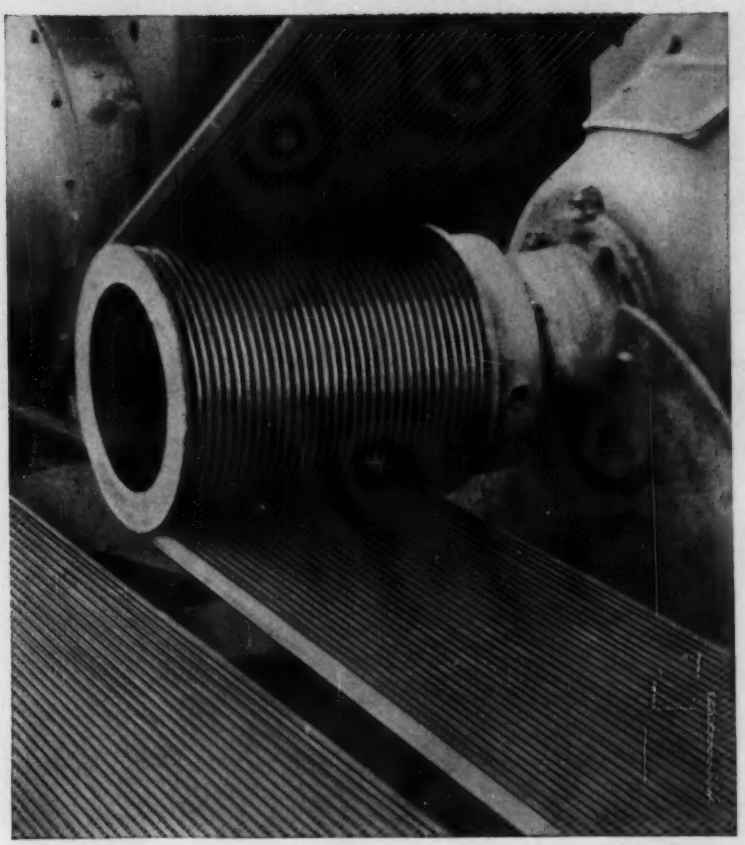
RAYBESTOS-MANHATTAN, INC.

MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM

RM 1023

ENGINEERED RUBBER PRODUCTS ..."MORE USE PER DOLLAR"



R/M POLY-V® DRIVE

More Power—
in Less Space
... with Reliability

A *single unit* V-ribbed belt across full width of the drive-sheave—*not* an assembly of V-belts—enables patented Poly-V to deliver much *more* power in the same space as a V-drive . . . or *equal* power in much *less* space! Single unit belt design also eliminates belt "length matching" problems ... minimizes equipment down-time and belt replacement costs. Belt speed ratios remain constant from *no* load to *full* load to provide the smoothest running, coolest running—*longest wearing* drive you can install. Maintain groove shape. Just two sections of Poly-V Belt meet every heavy duty power transmission requirement. Write for Bulletin M141, or call your R/M Distributor.

CONVERT TO RM POLY-V and BE SURE!

RAY-MAN CONVEYOR BELT

Engineered for 45° Idlers

- TRAINS NATURALLY
- TROUGHS DEEPLY
- HOLDS FASTENERS
- RESISTS IMPACT AND RIPPING
- REQUIRES NO BREAKER PLY
- DOUBLE COMPENSATION RELIEVES OUTER PLY STRESS
- EXCLUSIVE "XDC" LONG-WEAR COVER

Every component of a Ray-Man Conveyor Belt is *precision proportioned* to give you a balanced belt construction, with as much as ⅓ longer life expectancy. It's the same as getting ⅓ more conveyor belt for your money. Further savings are possible, if you use 45° Idlers. Properly engineered, you can haul a fuller load, or install a narrower conveyor. Ray-Man is guaranteed against ply or cover separation at the hinge line where the 45° angle proves too sharp for regular belt constructions. Write for Bulletin M303.

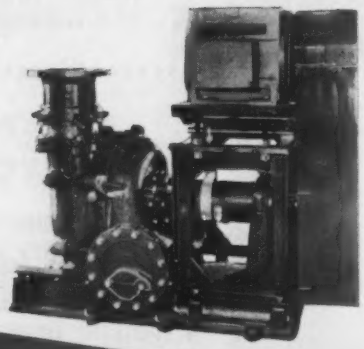
WILFLEY

SAND PUMPS

"True PUMPING ECONOMY Starts After You Buy a Pump!"

Price alone does not determine the actual value of a pump. Quality, efficiency, never-failing dependability . . . these are the prime factors a pump **must** have to give you **true** pumping economy. They pay off in low operating costs month after month, year after year.

WILFLEY SAND PUMPS guarantee true pumping economy through CONTINUOUS, MAINTENANCE-FREE SERVICE, LONGER PUMP LIFE, QUICK, EASY REPLACEMENT of PARTS, and MAINTAINED HIGH EFFICIENCY.



Wilfley Sand Pumps may be fitted with interchangeable electric furnace alloy iron, special application alloys or rubber-covered wear parts. Write, wire or phone for complete details.

Every Wilfley Installation is JOB ENGINEERED

A. R. WILFLEY AND SONS, INC.

Denver, Colorado, U.S.A. P.O. Box 2330

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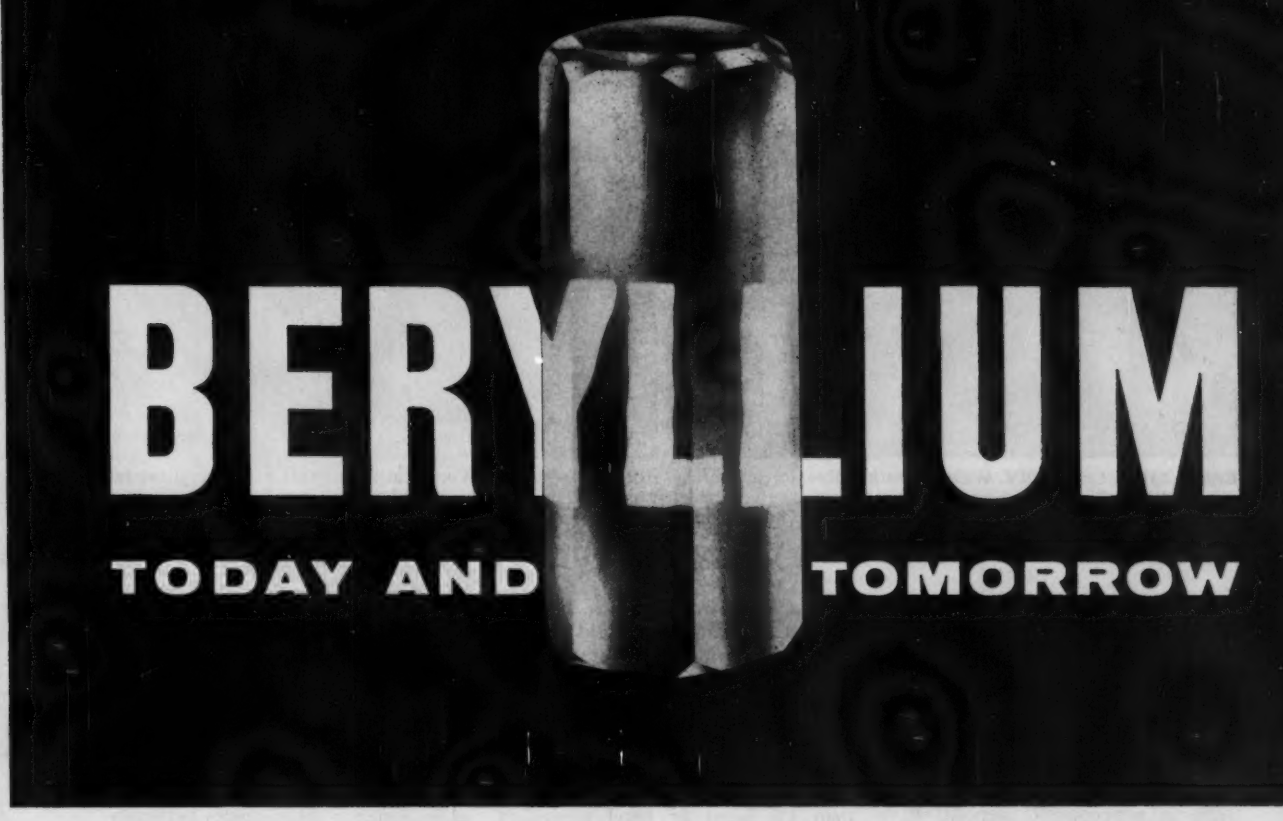


BERYLLIUM

TODAY AND TOMORROW

ENTHUSIASTIC BUSINESS AND POPULAR PRESS reports about beryllium compounded by claim-staking rushes in a search for beryllium mineral resources have created a confusing picture. Lest this fast-growing industrial metal risk the setback of becoming a "Cinderella" metal, as did titanium, it's time now to appraise the facts about beryllium. The following pages set down facts and opinions from many reliable sources which will enable you to draw your own conclusions about beryllium's position—today and tomorrow.

Here are some of ours:

1. There is no basis for a beryllium boom paralleling that of the recent uranium boom simply because the strategic need has not yet been developed which will warrant the Government to set up the elaborate bonus and incentive systems, which it did for uranium.

2. Beryllium resources are decidedly limited in the U.S., and it has been the policy of Government agencies as well as private companies entering this field to search for and develop adequate reserves on a long-range basis.

3. The companies such as Brush Beryllium Co. and Beryllium Corp. which have been largely responsible for the growing demand for beryllium metal and compounds in industrial fields see a continued healthy growth potential, maybe as high as 5 to 10% per year.

4. Others entering the field for the production of beryllium concentrates, and possibly metal and compounds, share this optimistic outlook with the added confidence that research, now going on at a good pace, may overcome metallurgical difficulties and price problems that could create a real surge in beryllium requirements. For example, if substantial resources can be developed, and if three-dimensional ductility of beryllium metal can be achieved, and if metallurgical costs can be cut, beryllium could be used economically as a substitute for aluminum in aircraft. But the answer to these "ifs" is not in immediate sight. If research in these directions proves successful, such progress will constitute the signals for a possible boom in the future.

5. In the world market for beryl ores, principal source of beryllium, there has been no uneasiness concerning supply nor any pressure on higher prices. The domestic price, supported by a limited GSA buying program, is $46 to $48 per short ton unit of BeO for ores running 10 to 12% BeO. The world market price for comparable grade ores is currently $31.75 to $34.50 depending upon grade and whether the sales are for spot delivery or long-term contract.

6. Independent mineral producers will be well advised to establish a market for their products before expanding mining and milling capacity for beryllium ores. This might be done through negotiations with present or future companies that will be able to process beryllium concentrates and develop commercial markets. Several new large companies searching for beryllium resources are going on with plans for a long-range, fully-integrated, mine-to-market objective.

7. The accelerated search for beryllium minerals in Canada, Latin America and elsewhere might saturate the near-by market for beryllium raw materials. However, speeded-up exploration in the U.S. and abroad might develop substantial resources that would encourage designers of aircraft and spacecraft to adopt beryllium more enthusiastically, and thereby enhance the long-range outlook for the metal. Difficult calculated risks such as these mean that companies entering the beryllium field will need adequate financial resources, competent technical ability, and a thorough understanding of the economics of the industry.

8. It would be a pleasure to report that the same opportunities exist today for the beryl hunter that existed ten years ago for the uranium prospector with a jeep and geiger counter. But we do not believe that the facts on the following pages support this contention. First because the combined value of domestic and imported beryl last year totaled about $2.26-million, as compared with the $290-million domestic uranium ore market. Secondly berylometers cost about $2,500.

9. If there should be an urgent need for heavily increased output of beryllium minerals for military or strategic purposes, we believe that the proper Government agencies will notify the mining industry about this need. If there is to be a beryllium boom, here is another signal to watch.

A. Knoerr, Editor

BERYLLIUM COUNTRY. Wide pegmatite dikes, often several thousand feet long, cut through Colorado's productive Gunnison County. Dry mica screening mill recovers by-products from the pegmatite. Worker at right spans a 3-ft beryl crystal which will be picked out and cobbed for market. Pegmatites are the major source of beryl today.

U.S. Beryllium Resources

United States was reported to have the following reserves in 1957: 8,800 tons of beryl (440 tons of beryllium) in pegmatite deposits containing at least 1% beryl and at least 100 tons of beryl; and 3,300 tons of beryl or equivalent beryl (165 tons of beryllium) in nonpegmatite deposits having the same tenor. Distribution of this 605 tons of beryllium is as follows:

In pegmatites	
South Dakota	175 tons
New England	180 tons
Colorado	50 tons
Idaho, Nevada and New Mexico	35 tons
In nonpegmatites, various states	165 tons

An earlier estimate (1950) indicated that the U.S. had 271,800 tons of beryl (13,590 tons of beryllium) in pegmatite deposits containing at least 0.1% beryl and 10 tons of beryl, and 7,200 tons of beryl or equivalent beryl (360 tons of beryllium) in nonpegmatite deposits of the same tenor. Distribution of this 13,950 tons of beryllium is as follows:

In pegmatites	
North Carolina	12,190 tons
South Dakota	800 tons
New England	350 tons
Colorado	175 tons
Idaho, Nevada and New Mexico	65 tons
Other states	10 tons
In nonpegmatites, various states	360 tons

World Beryllium Resources

U.S. Bureau of Mines reports that because of lack of complete information, world reserves have been estimated by comparing world production figures with those for the U.S. during the 1935-51 period. The ratio was 14:1. Assuming that reserves of the world bear a 14:1 ratio to estimated domestic reserves, it was estimated that world resources of beryllium in deposits containing more than 1% beryl or beryl equivalent would total about 200,000 tons (10,000 tons of beryllium.) Total resources in world deposits containing 0.1% beryl or beryl equivalent was calculated to be about 4-million tons (200,000 tons of beryllium.)

Geologic Occurrences

Because of beryllium's potential uses in nuclear reactors and in spacecraft, it has become one of the most thoroughly investigated strategic minerals during the last decade. Voluminous reports prepared by the U.S. Geological Survey and the U.S. Bureau of Mines on behalf of the U.S. Atomic Energy Commission will give the reader ample source material for research and study of beryllium geology. See Bibliography of selected references. A surge of interest in lithium minerals some years ago added substantially to current knowledge of pegmatites.

Beryllium constitutes 0.0006% (approx.) of the earth's crust (6 parts per million, as compared with 16 parts per million for lead). It occurs in more than 30 minerals (some of which appear in Table 6). Beryl in pegmatites has been almost the exclusive source to date. Other important minerals are bertrandite, chrysoberyl, helvite and phenacite. If a mineral now under investigation in the Topaz Mountain area of Utah proves to be new, possibly "Vitroite" will take its place among the commercial sources of beryllium.

Nearly all reports break down beryllium occurrences into two classifications of deposits: pegmatite and nonpegmatite. The mineral map of U.S. occurrences based on various sources of information differentiates betweeen these two types of deposit (p 96).

Pegmatite Sources

To date, nearly all beryl has come from heterogeneous pegmatites where it has been possible to pick out enriched zones and beryl crystals occasionally weighing hundreds, or even thousands of pounds. The beryl cobbed out of such deposits represents what has been classified in minerals markets as "beryl ore." Homogeneous pegmatites have yielded little beryl, but metallurgical processes under development make them commercially attractive.

A study of granite pegmatites, the world's principal source of beryllium,[1] classified the grade of beryl in zoned pegmatites as follows: Very abundant, 2% beryl content; abundant 1%; common 0.5%; rare, 0.1%. Thus even in the richest of pegmatite orebodies, beryl occurs sparsely. In actual mining some 100 to 300 tons of rock must be moved and examined to gather one ton of beryl.

In rare instances, bonanza aggregates of beryl occur. In one deposit in the U.S. an aggregate consisting almost entirely of beryl contained 60 tons, another may have contained

[1]Internal Structure of Granite Pegmatites. ECONOMIC GEOLOGY, 1949.

(Continued on p 98)

Table 1. Growth of Beryllium Industry in the United States 1950 Through 1959

Year	Sales	Investment in plant & equipment	Beryl consumption, short tons
1950	$ 9,485,992	$ 3,392,843	3,007
1951	10,783,261	4,442,400	3,388
1952	12,619,411	5,809,202	3,476
1953	12,000,503	6,742,493	2,661
1954	9,519,484	8,008,598	1,948
1955	15,838,870	8,838,014	3,860
1956	23,155,753	10,176,504	4,431
1957	24,123,260	17,896,010	4,309
1958	27,448,189	17,205,831	6,002
1959	39,312,774	20,739,085	8,100 Est.

Source: "Beryllium Ore Market," paper presented by D. H. Hershberger, treasurer, Brush Beryllium Co., before the National Western Conference, April 23, 1960, Denver, Colo.

Table 2. Beryllium Production & Consumption[1]

	1949–1953 Avg.	1954	1955	1956	1957	1958	1959
United States							
Beryl, approx. 10–12% BeO							
Domestic mine shipments	557	669	500	445	521	463	328
Value	$214,545	$303,649	$267,927	$231,126	$275,855	$238,017	$170,523
Imports	5,393	5,816	6,037	12,371	7,290	4,599	8,038
Consumption	2,712	1,948	3,860	4,341	4,309	6,002	8,173
Approx. price per unit BeO, dom.[2]	$39	$45	$49	$47	$48	$47	$47
Approx. price per unit BeO, imported (10% BeO)	$36	$44	$37	$36	$35	$34	$29
World beryl production 10–12% BeO	6,800	7,700	8,900	12,900	11,900	7,000	7,300

[1]Source: "Beryllium," U.S. Bureau of Mines Minerals Yearbook, Donald Eilertsen, commodity specialist.
[2]10% BeO, 1949–54; 11% BeO, 1955–58.

Table 3. United States Beryl Supplies, 1936 Through 1959

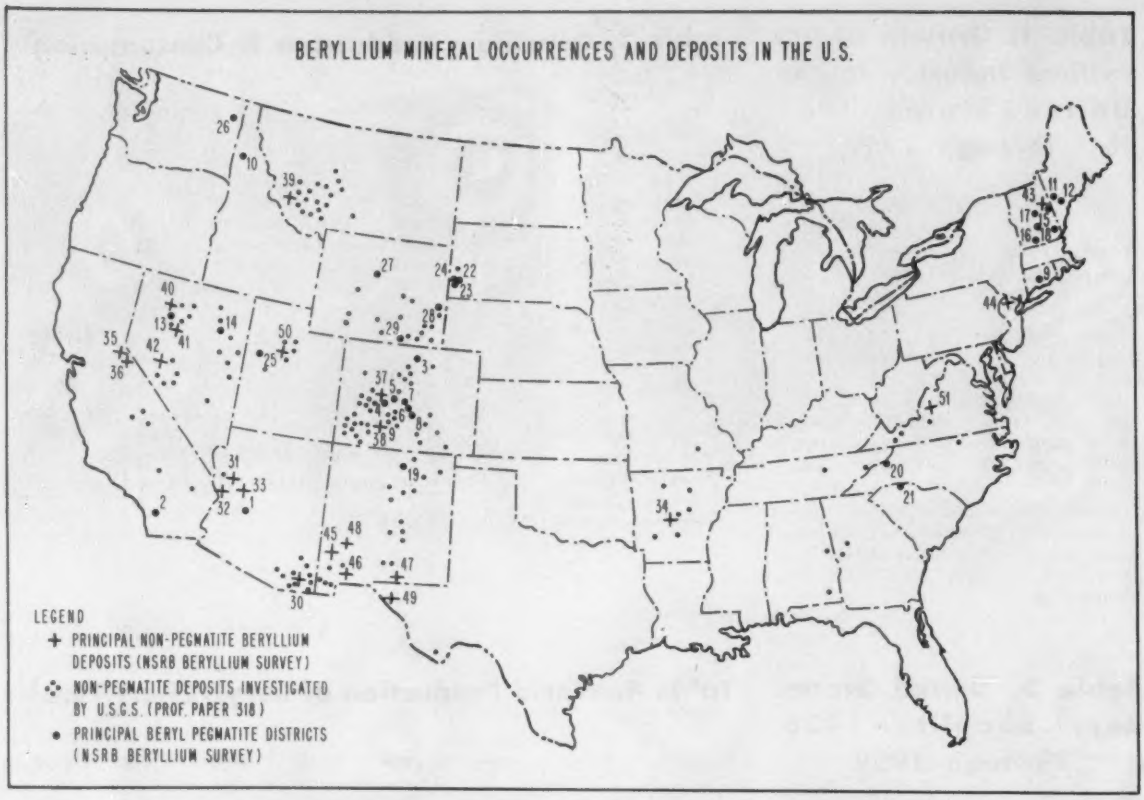
Year first supplied	Received from:	Short tons	Present total supply
1936	Brazil	35,331	36%
1936	Argentina	13,830	14
1936	Union of South Africa (includes S. W. Africa)	10,246	10
1937	India	9,786	10
1936	United States	7,645	8
1948	Mozambique	6,822	7
1944	Rhodesia and Nyasaland	6,319	6
1954	Belgian Congo	2,936	3
1943	Portugal	1,536	2
1943	Australia	1,145	1
1943	Madagascar	1,104	1
1944	British East Africa	612	1
1949	French Morocco	289	
1949	Japan	136	
1956	Pakistan	84	
1954	Sweden	46	
1950	Canada	29	
1956	British Somaliland	29	
1945	Nigeria	25	
1956	British West Africa	22	1
1952	Republic of Korea	21	
1948	Hong Kong	19	
1949	Norway	17	
1954	Afghanistan	11	
1954	Surinam	10	
1951	Finland	9	
1944	Anglo-Egyptian Sudan	1	
		98,060	100%

Source: "Beryllium Ore Market," paper presented by D. H. Hershberger, treasurer, Brush Beryllium Co., before the National Western Conference, April 23, 1960, Denver, Colo.

Table 4. World Production of Beryl, Short Tons[1]

Country	1950–54 Avg.	1955	1956	1957	1958	1959
North America						
United States	596	500	445	521	463	328
South America						
Argentina	452	1,488	1,722	1,571	1,004	660[3]
Brazil	2,245	1,954	2,321	1,452	1,295	2,200[3]
Total	2,697	3,442	4,043	3,023	2,299	2,860[3]
Europe						
Norway[4]	...	...	...	...	3	4
Portugal	211	337	244	191	52	19
Sweden	...	...	...	...	28[5]	28
Total[2 3]	300	440	340	300	200	150
Asia						
Afghanistan	10	33	30	15	...	...
India[4]	247	845	3,360	1,256	600	...
Korea, Republic of	2	6	...	...	...	...
Total	259	884	3,390	1,271	600	...
Africa						
Belgian Congo, incl. Ruanda Urandi	29[6]	362	1,905	1,771	1,113	467
British Somaliland	...	19	17	...	...	...
Kenya	1[7]	...	...	6	4	2
Madagascar	545	316	169	299	180	463
Morocco, southern zone	69	2	...	...	...	...
Mozambique	410	960	944	1,871	1,134	1,548
Rhodesia & Nysaland						
Northern Rhodesia	6	21	13	5	13	2
Southern Rhodesia	1,216	963	606	572	332	440
South West Africa	660	472	454	385	246	170
Uganda	43	110	98	78	86	234
Union of South Africa	547	137	133	711	464	214
Total	3,526	3,362	4,339	5,696	3,572	3,540
Oceania						
Australia	111	230	356	442	278	400[3]
World Total[8]	7,500	8,900	12,900	11,300	7,400	7,300

[1]Source: Mineral Industry Surveys, USBM, 1959. Data has been rounded out to nearest estimated figures. [2]An estimate of USSR production is included in this total. [3]Estimate. [4]US imports. [5]Less than ½ ton. [6]Avg. for 1953-54. [7]Avg. for 1952–54.


BERYLLIUM MINERAL OCCURRENCES AND DEPOSITS IN THE U.S.
LEGEND
+ PRINCIPAL NON-PEGMATITE BERYLLIUM DEPOSITS (NSRB BERYLLIUM SURVEY)
NON-PEGMATITE DEPOSITS INVESTIGATED BY U.S.G.S. (PROF. PAPER 318)
• PRINCIPAL BERYL PEGMATITE DISTRICTS (NSRB BERYLLIUM SURVEY)

Key to Beryllium Mineral Occurrences in the U.S.

Beryl Pegmatite Districts

Arizona
1. Maricopa County, Wickenburg district

California
2. San Diego County, Pala district

Colorado
3. Larimer County, Crystal Mountain district
4. Gunnison County, Quartz Creek district
5. Chaffee County, Trout Creek Pass-Turret region
6. Fremont County, Eight-Mile Park district
7. Fremont and Park Counties, Micanite district
8. Park County

Connecticut
9. Middlesex and Hartford Counties, Middletown district

Idaho
10. Latah County, Avon district

Maine
11. Oxford County
12. Androscoggin County

Nevada
13. Pershing County, Oreana district
14. Elko County, Ruby Mountains district

New Hampshire
15. Carroll County
16. Cheshire and Sullivan Counties, Keene district
17. Grafton County, Grafton district
18. Rockingham County, Raymond district

New Mexico
19. Taos County, Harding mine

North Carolina
20. Tri-County district

North and South Carolina
21. Tin-Spodumene belt

South Dakota
22. Pennington County, Keystone district
23. Custer County, Custer district
24. Pennington County, Hill City district

Utah
25. Tooele County, Granite Mountain district

Washington
26. Stevens County, Chewelah district

Wyoming
27. Fremont County, Copper Mountain district
28. Goshen County, Haystack Range district
29. Albany County, Fox Park district

Non-Pegmatite Beryllium Deposits

Arizona
30. Cochise County, Dragoon Mountains
31. Mohave County, Hualpai Mountains
32. Mohave County, Oatman district
33. Yavapai County, Bagdad area

Arkansas
34. Hot Spring County, Magnet Cove

California
35. Inyo County, Little Sister mine
36. Inyo County, Tungstar mine

Colorado
37. Chaffee County, Mt. Antero
38. Gunnison County, Iron Hill

Montana
39. Deer Lodge County, Anaconda district

Nevada
40. Humboldt County, Golconda mine
41. Mineral County, Rawhide district
42. Pershing County, Humboldt Mountains

New Hampshire
43. Carroll County

New Jersey
44. Sussex County, Franklin district

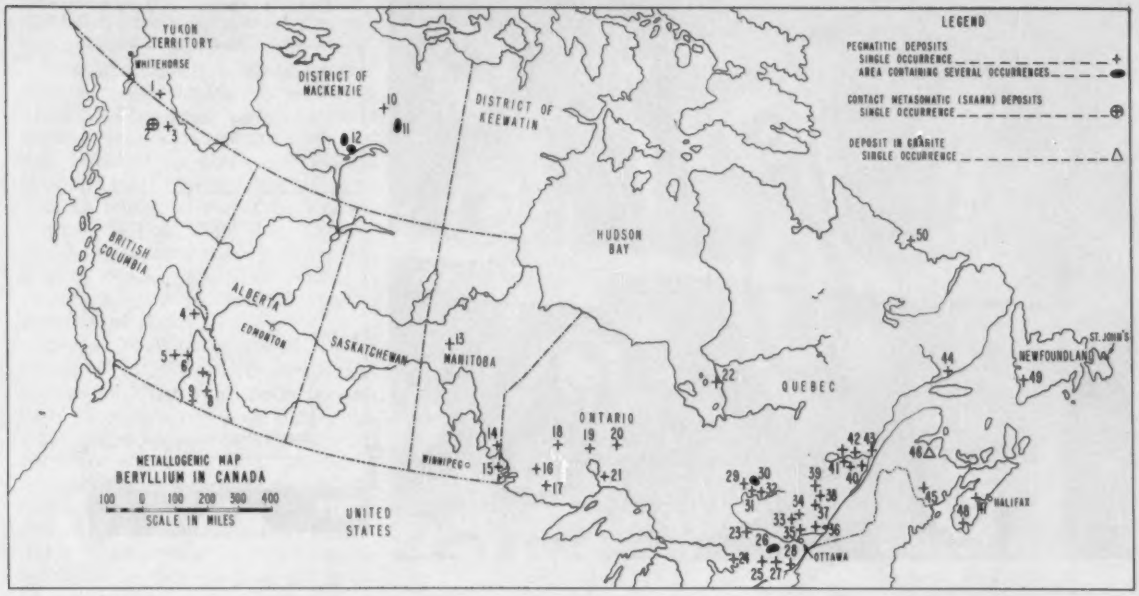
New Mexico
45. Grant County, Carpenter district
46. Luna County, Victorio district
47. Otero County, Cornudas Mountains
48. Sierra and Socorro Counties, Iron Mountain district

Texas
49. Culberson County, Sierra Diablo

Utah
50. Juab County, Sheeprock Range, West Tintic district

Virginia
51. Rockbridge County, Irish Creek district

Source: National Security Resources Board, Materials Survey of Beryllium, September 1953. Non-identified dots represent deposits studied or examined as reported in "Occurrences of Nonpegmatite Beryllium in the United States," U. S. Geological Survey Professional Paper 318.



Legend—Canadian Beryllium Mineral Occurrences

1. Wolf Lake area, Cassiar Mountains (beryl)
2. Low Grade claims, Needlepoint Mountain (helvite)
3. Cassiar Beryl claims, Horseranch Range (beryl)
4. Bonanza Mica Mine (beryl)
5. Fly Hill, near Salmon Arm (beryl)
6. Mt. Bigbie (beryl)
7. Erdahl and Pinchbeck claims, Duncan River (mineral not identified)
8. White Creek (beryl)
9. Midge Creek (beryl)
10. Paul Lake (beryl)
11. Aylmer Lake area (beryl)
12. Yellowknife-Beaulieu region (beryl)
13. Herb Lake area (beryl)
14. Cat Lake-Winnipeg River area (beryl, gadolinite)
15. Lucy No. 1 claim, West Hawk Lake area (beryl)
16. Zealand township (beryl)
17. Turtle Lake (beryl)
18. Lake St. Joseph area (beryl)
19. Linklater Lake (beryl)
20. Saga Lake (beryl)
21. Orient Bay area (beryl)
22. Walrus Island, James Bay; Paint Hills Group
23. Calvin township (beryl)
24. Conger township (beryl)
25. Monmouth township (beryl)
26. Raglan and Lyndoch townships, Jacobus Mining Corp. (beryl, chrysoberyl)
27. Madoc township (beryl)
28. Loughborough township (gadolinite)
29. Height-of-Land mine, Preissac township (beryl, phenacite)
30. Lacorne township (beryl)
31. Desroberts township (beryl)
32. Granet township (beryl)
33. Robertson township. P. Arbic and J. H. Lamarche, Mont Laurier, Quebec (beryl, chrysoberyl)
34. Campbell township (beryl)
35. Villeneuve mine, Villeneuve township (beryl)
36. Wentworth township (beryl and leucophane)
37. Brassard township (beryl)
38. Maisonneuve mine (beryl)
39. Riviere du Poste (chrysoberyl)
40. Lac Pied des Monts, Lacoste township (beryl)
41. Chicoutimi County (beryl)
42. Lac Xavier mica mine, Harvey township (beryl)
43. McGie mica mine, Bergeronnes township (beryl)
44. Grand Watsheshou river, Drucourt township (beryl)
45. Burtts Corner, York County (beryl)
46. Pigeon Lake, Bathurst township (beryl)
47. Reeves Farm, New Ross (beryl)
48. Jordan Falls area, Shelburne County (beryl)
49. Indian Head area (beryl)
50. Nutak area, British Newfoundland Exploration Ltd. (beryl)

Source: Department of Mines & Technical Surveys, Geological Survey of Canada, Ottawa. Beryllium occurrences are plotted on a transparent overlay map to the same scale as the colored geologic base map of Canada.

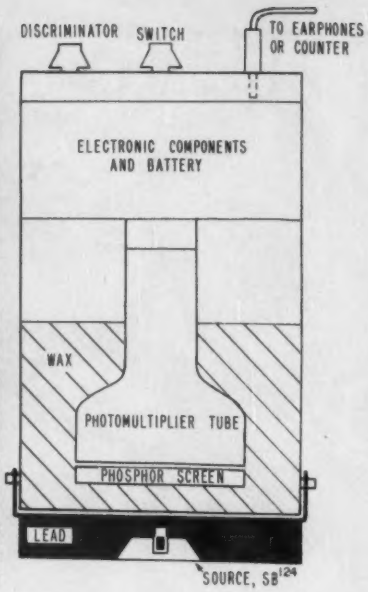
Table 6. Principal Beryllium Minerals[1]

Mineral	Composition	S.G.	Theoretical BeO Content	Per cent Be[2]	Type of occurrence
Barylite	$Be_2BaSi_2O_7$	4.0	15	5.6	Contact metamorphic
Bertrandite[3]	$4BeO \cdot SiO_2 \cdot H_2O$	2.6	42	15.1	Granitic pegmatite
Beryl[3]	$3BeO \cdot Al_2O_3 \cdot 6H_2O$	2.6–2.8	14	3.0–3.5	Granitic pegmatite
Beryllonite	$Na_2O \cdot 2BeO \cdot P_2O_5$	2.8	20	7.1	Granitic pegmatite
Brommellite	BeO	3.0	100	36.0	Contact metamorphic
Chrysoberyl[3]	$BeO \cdot Al_2O_3$	3.5–3.8	20	7.1	Granitic pegmatite
Euclase	$2BeO \cdot Al_2O_3 \cdot 2SiO_2 \cdot H_2O$	3.1	17	6.1	Granitic pegmatite
Eudidymite	$Na_2O \cdot 2BeO \cdot 6SiO_2 \cdot H_2O$	2.6	10	3.7	Nepheline syenite
Gadolinite	Variable	4.0–4.5	10	3.2–4.7	Granitic pegmatite
Hambergite	$4BeO \cdot B_2O_3 \cdot H_2O$	2.3	53	19.2	Granitic and syenitic
Helvite[3]	Mn, Fe, Be sulfosilicate	3.2–3.4	14	3.8–5.4	Various
Herderite	$CaO \cdot CaF0H \cdot 2BeO \cdot 2P_2O_5$	3.0	15	5.6–5.9	Granitic pegmatite
Leucophanite	Ca, Na, Be fluosilicate	3.0	10	4.0	Syenitic pegmatite
Meliphanite	Ca, Na, Be fluosilicate	3.0	13	3.4–5.0	Syenitic pegmatite
Phenacite[3]	$2BeO \cdot SiO_2$	3.0	46	16.4	Granitic pegmatite

[1]Source, National Security Resources Board Material Survey, Beryllium, September, 1953.

[2]BeO is 36% Be. Other minerals containing Be include cassiterite, fluorite, wavellite, garnet, vesuvianite, nepheline, tourmaline, the micas.

[3]More important potential beryllium source minerals.



BERYLOMETER used by International Minerals & Chemical Corp. engineers is demonstrated by Drs. Donald Everhart, chief geologist; I. M. LeBaron, vice president of research engineering and development; and Jack Silman, beryllium geologist. The berylometer (right) described by Louis and Pauline Moyd (E&MJ, March 1960) contains radioactive Sb-124 in base which emits hard gamma rays. When striking beryllium sample, they force it to give off neutrons which strike the phosphor screen of a scintillation counter. The unit can be used to make rough assays of crushed ore samples.

200 tons. In Argentina a tabular mass contained more than 3,000 metric tons of beryl.

If efficient methods can be developed to extract the spodumene, feldspar, mica, cassiterite and columbite, as well as beryl, in the extensive tin-spodumene pegmatite belt of North Carolina, this area may become one of the principal future sources of beryllium in the U.S. Pegmatite dikes in this area uniformly contain 0.05% BeO. The most abundant minerals in the pegmatite contain from 0.001 to 0.01% BeO. Beryl, containing 12 to 12.3% BeO, is the only beryllium-rich mineral and contains more than 80% of the total beryllium in the rock.

USGS Circular 309 by W.R. Griffitts summarizes resources in this area as follows: "The minable spodumene ore in Kings Mountain area, above a depth of 300 ft. contains 40,000 tons of beryl, equivalent to 6,000 tons of BeO, if 80% of the BeO is assumed to be in beryl. Other pegmatite in the area contains an additional 238,000 tons of beryl, or 35,900 tons of BeO. On the basis of the same assumptions the spodumene ore above a depth of 300 ft in the Beaverdam Creek area contains 6,000 tons of beryl, or 800 tons of BeO, and all other pegmatite in the area contains an additional 13,000 tons of beryl, or 1,700 tons of BeO. The entire tin-spodumene belt contains 823,000 tons of beryl, equivalent to 122,800 tons of BeO."

Nonpegmatite Sources

An exhaustive investigation and report by the U.S. Geological Survey, prepared on behalf of the AEC, summarizes the occurrence of nonpegmatite beryllium in the U.S. (U.S. Geological Survey Professional Paper 318, released in 1959). Although to date of publication, no deposits of commercial value were noted, the investigation sets criteria that will be useful in future exploration. The unidentified dots on the beryllium map, p. 96, indicate many of the localities investigated. The report notes that other than in pegmatites, beryl-minerals are found chiefly in quartz-tungsten veins and pyrometasomatic deposits. Small amounts also occur in other types of veins, particularly quartz-gold and manganese veins. In most of these occurrences, beryllium is found with fluorite. In pyrometasomatic deposits it sometimes occurs with fluorine-rich beryllian idocrase.

Concentrations of beryllium in sedimentary rocks sampled were low because beryllium tends to be dissipated by processes of weathering and sedimentation. Concentrations reported for sandstones, shales and limestones ranged from 0.0001 to 0.007% BeO. In residual manganese deposits, BeO concentrations ranging from 0.01 to 0.05% were reported.

Metamorphic and pyrometasomatic deposits investigated yielded assays of BeO that were commercially unattractive.

Topaz Mountain Rush

Another more prominent nonpegmatite beryllium mineral area, which has been the scene of a claim-staking rush, is the Topaz Mountain area south of Utah's Great Salt Lake. Extensive leases and holdings have been acquired by Vitro Minerals Corp. and Beryllium Resources Inc. Other companies reported to be prospecting in the area are E.I. DuPont, U.S. Steel, Food Machinery & Chemical Corp., Combined Metals Reduction Co. and others.

Beryllium minerals in the Topaz Mountain nonpegmatite deposit are disseminated in a volcanic tuff, overlain by rhyolite. Mineralization is regarded as hydrothermal. In late July, Beryllium Resources, Brush Beryllium Co. and Vitro Minerals Corp. announced that the ores in this area will be amenable to conventional hydrometallurgical processing. On Aug. 12, Vitro Minerals said that some 10% of the claim area had been test drilled and indicated "sizeable" ore zones which could be mined by open-pit methods.

Exploration with Berylometer

The berylometer is to the beryllium hunter what the geiger counter was to the uranium prospector. It's consider-

ably more expensive, however, costing approximately $2,500.

Illustrations on p. 98 show a model used by International Minerals & Chemical Corp. in its search for beryl deposits, and a schematic drawing of one described by Louis and Pauline Moyd (E&MJ, March 1960, p. 104). The latter unit, developed by Nuclear Enterprises Ltd., Winnipeg, Canada, and manufactured and sold in the U.S. by Nuclear Corp. of America's western division at Burbank, Calif., operates as follows:

Inside the detector are 80 millicuries of antimony 124, which emit hard gamma rays. These convert ordinary beryllium (Be9) to Be8—forcing it to give up neutrons. The released beryllium neutron is then counted by a scintillator designed to favor neutron response while suppressing gamma rays. A similar instrument for quantitative determination of beryllium by activation analysis for field use is described and illustrated in Geological Survey Circular 427. Samples are crushed to approximately 1/4-in. or smaller and placed in a standard measuring cup. Instrument calibration made by using standard of known BeO content indicates the analyses are reproducible and accurate to within 0.25% BeO in the range from 1 to 20% BeO with a sample counting time of five minutes.

Analysis of Be in Rocks

The spectrographic method appears to be the most reliable for quantitative determination of small amounts of beryllium in rocks and minerals, according to USGS. The lower limit of accurate spectrographic determinations is in the range 0.005 to 0.0001% BeO. A quantitative spectrochemical (spectrographic) method to analyze rocks, including those containing beryllium, employing the powder dc arc technique is described in USGS Bulletin 1084-G.

Other methods of analysis used include the gravimetric, colorimetric and fluorometric techniques.

Milling and Extraction

To date nearly all beryl has been sorted and hand cobbed. With the growing interest in recovering beryllium from disseminated ores, flotation tests have been conducted on a laboratory scale, but recovery on a commercial scale has been difficult.

The attractive possibility of recovering numerous minerals from pegmatite such as mica, feldspar, spodumene, columbite, tantalite, topaz and tin, in addition to beryl, has stimulated research in differential flotation techniques. In a sense, the by-products plant at Climax Molybdenum Co in Colorado has accomplished this objective. Molybdenum tailings are treated by a combination process involving Humphreys spirals, tables, flotation and magnetic separators, to yield topaz, pyrite, tin wolframite and heavy minerals (E&MJ, November 1956). Source of these minerals is the pegmatite dikes that invade the orebody, as well as the ore itself.

Flotation experiments conducted by the USBM on New England pegmatite yielded a 12.2% BeO concentrate, with 74.7% recovery. A low-grade ore yielded an 8.05% BeO concentrate with a 69.3% recovery. Spodumene could not be separated by flotation, and was recovered by heavy media. Source: USBM R.I. 4040.

Differential flotation plus spiral classifiers recovered quartz, beryl, mica, feldspar and heavy minerals in a USBM test on pegmatite ore from the Peerless mine, South Dakota. A combination of hand sorting and flotation yielded the highest recovery. Muscovite was floated first by adding an amine collector in an acid circuit using sulphuric acid and a frother. A beryl-iron-feldspar bulk concentrate was then floated, using a hydrofluoric acid activator, amine collector and high-alcohol frother. Beryl and iron minerals were separated from feldspar by conditioning with hypochlorite to break down the amine froth and activate the beryl. Beryl was floated with petroleum sulphonate. Source: USBM R.I. 5061.

In another South Dakota test using similar equipment and reagents, a series of samples ranging from 0.1%

Table 5. Beryl Shipped from Mines in USA, Short Tons[1]

State	1950–54 Avg.	1955	1956	1957	1958	1959
Colorado	76	46	163	182	134	124
New Hampshire	*	20	*	4	14	20
New Mexico	*	106	31	29	27	11
South Dakota	259	294	195	268	240	156
Other[2]	261	34	56	38	48	17
Total, short tons	596	500	445	521	463	328

[1]Source: USBM Industry Survey, Beryllium 1959, Donald Eilertsen, commodity specialist.

*Included in other states to avoid disclosing individual company data.

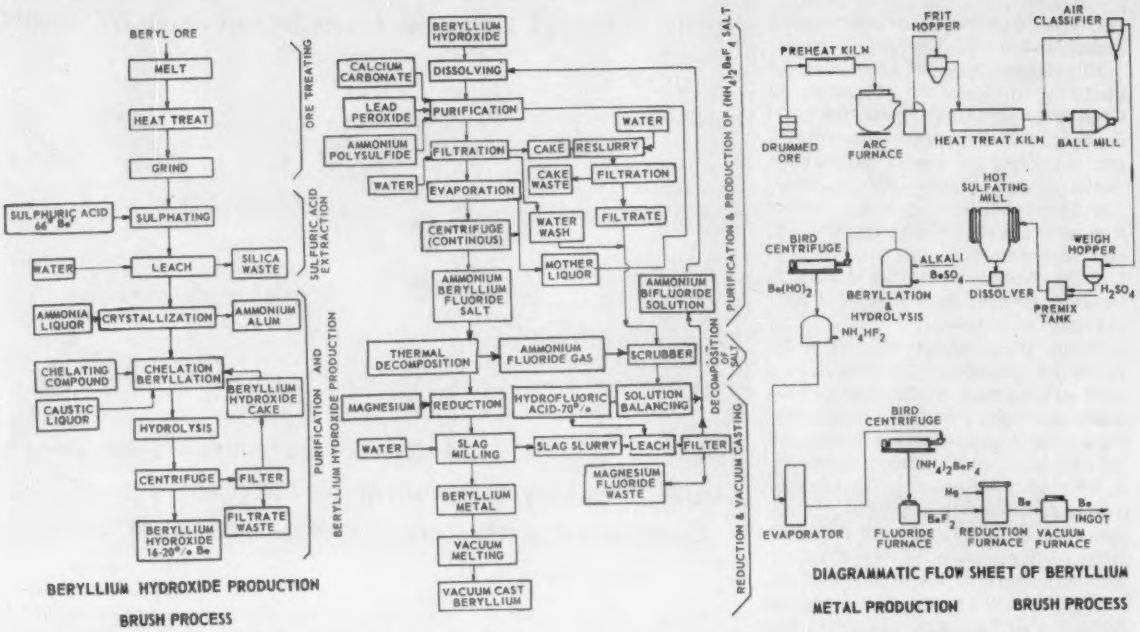
[2]Production during various periods came from Arizona, Connecticut, Georgia, Idaho, Maine, Maryland, New York, North Carolina, Virginia, Wyoming.

Table 7. Calculated Ore Requirements of Beryllium Industry According to Formula $y = 2X^{2.43}$ Compared with Actual Consumption of Beryl[1]

Year	Short Tons of Beryl Calculated	Actual	Year	Short Tons of Beryl Calculated	Actual
1931	2		1949	2560	1029
1932	10.8		1950	2900	3007
1933	29		1951	3270	3388
1934	58		1952	3660	3476
1935	100		1953	4070	2661
1936	156	200	1954	4520	1948
1937	226	200	1955	4990	3860
1938	312	300	1956	5310	4431
1939	420	500	1957	6020	4309
1940	540	600	1958	6570	6300
1941	680	1200	1959	7160	7000
1942	840	2352		(forecast)	
1943	1040	3058	1960	7770	
1944	1240	2176	1961	8410	
1945	1440	1738	1962	9090	
1946	1700	1013	1963	9800	
1947	1940	1735	1964	10530	
1948	2250	1970	1965	11300	

Source: "Beryllium Ore—Present and Future Market Situation," a paper presented by David Hershberger, treasurer, Brush Beryllium Co., at the Feb. 7, 1959, meeting of the National Western Mining Conference of the Colorado Mining Assn.

[1] Variables in the formula $Y = 2X^{2.43}$ are: Y= year's consumption of beryl in short tons. X= number of years which elapsed beginning with 1931. The final figure for beryl consumption in the U.S. appears in Table 2.



PRINCIPAL STEPS in production of beryllium metal include sulphuric acid extraction of $BeSO_4$ from beryl ore, purification to form $Be(OH)_2$ which is treated with NH_4HF_2 to form BeF_2. This is reduced with magnesium to make beryllium, which is heated and cast in a vacuum furnace to form ingots for market. Source: Brush Beryllium Co.

BeO to 2.5% BeO were treated, yielding a recovery of 75.3% for the low-grade ores, and 94.5% for the highest-grade ores.

Chemical Extraction

Studies made by Vitro Minerals Corp. indicate that the new ore found in the Topaz Mountain area of Utah is readily soluble in sulphuric acid, and is apparently amenable to conventional hydrometallurgical processing. A joint announcement by Brush Beryllium Co. and Beryllium Resources Inc. in August claimed a "break-through" in the reduction of beryllium from ores in the same area. Company officials said that the process involves several hydrometallurgical steps which produce a beryllium hydroxide of the same quality produced by Brush from beryl minerals shipped from Africa.

As early in the youthful history of beryllium as 1929, E&MJ reported a hydrometallurgical process developed by the National Physical Laboratory in England which yielded beryllium oxide or carbonate of high quality from "any commercial source of supply," including ore. Reagents used were distilled water, ammonia, sulphuric acid and hydrogen peroxide. Hydrofluoric acid, produced as a by-product, was expected to carry half the expense of purification. The oxide produced was hygroscopic, and required sealing in cans.

In all metallurgical steps, including those which are subsequently described on extraction of the metal from raw materials, there is a dominant kinship between beryllium and fluorine; and it is possible that this linkage may aid in the exploration for beryllium minerals as well as assist in solving metallurgical problems. USGS Professional Paper 318 says that "the geological occurrence of beryllium may be related to the presence of fluorine, as fluorite is a common constituent in many beryllium-bearing tactites, veins and pegmatites."

Production of the Oxide

Just as the production of aluminum involves the production of alumina as an intermediate step, that of beryllium requires the intermediate step of hydroxide or oxide production. Two processes are mentioned most commonly in technical literature:

1. Copeaux-Kawecki process. Beryllium ore is ground to minus 200-mesh, mixed with soda ash, sodium silicofluoride and sodium ferric fluoride, and made into briquettes. These are sintered, cooled, crushed and slurried in water. The liquid, containing soluble sodium beryllium fluoride, is decanted. Caustic soda is added to precipitate BeOH, which is filtered, washed, dried and ignited to produce BeO.

2. Sawyer-Kjellgren process. Melted beryl is quenched in cold water to produce a frit, which reacts with sulphuric acid. The liquid containing soluble beryllium and aluminum sulphides is filtered, and treated with ammonium hydroxide. The filtrate from this operation is treated with a chelating agent to prevent impurities from precipitating upon the addition of sodium hydroxide. The resulting precipitated beryllium hydroxide is filtered off and ignited in an electric furnace to produce BeO.

Products from either process have to be purified to produce beryllium metal.

The Copeaux-Kawecki process is used by Beryllium Corp., and the Sawyer-Kjellgren process is used by Brush Beryllium Co.

Production of Beryllium

Hundreds of methods of producing beryllium metal have been studied, and more than 100 have been patented. But only a few are commercially successful.

Difficulty of extraction is due to the high melting point of the metal, the great stability of the oxide, and the intense chemical reactivity of the metal at high temperatures.

Methods which have been or are being used include reduction of beryllium oxide or halide with metals, decomposition of beryllium iodide, and fused salt electrolysis.

As early as 1927, E&MJ reported that beryllium metal had been pro-

duced in quantity by a process developed by Stock and Goldschmidt, which used a fused sodium-barium-beryllium fluoride as an electrolyte. Siemens and Halske AG of Germany had plans at that time to place the process on a commercial scale, if the price of the metal ($200 per lb) could be reduced to that of silver.

Electrolytic Methods

This process has been used in the U.S., Germany, France and Great Britain, and is currently under study by Murex Ltd., Great Britain. In this process, beryllium oxide and carbon are extruded in the form of sticks, and heated in chlorine to form BeCl. This is purified by sublimation, fused with NaCl, and electrolyzed at high temperature in a nickel cell to produce beryllium. Clifton Products Inc. used this process at one time. Difficulties encountered are high cell corrosion, high vapor pressures and danger of toxicity, and a relatively impure product.

Magnesium Reduction

Magnesium reduction of beryllium fluoride is the most common method. It is employed by Brush Beryllium Co., and by Imperial Smelting Co. in a pilot plant operated for the United Kingdom Atomic Energy Authority.

Details are shown in the accompanying flowsheets. Beryllium hydroxide and ammonium bifluoride solution react to form ammonium fluoberyllate, which in solution is freed of impurities by precipitation of the impurities. The fluoberyllate dissociates on heating, to form volatile ammonium fluoride and beryllium fluoride. The fluoride is heated with magnesium to produce pure beryllium and magnesium fluoride.

Potential Uses

Beryllium owes its growth as an industrial metal to unusual combinations of properties in the metal, oxide and alloy form which are peculiarly suited to applications as modern as nuclear energy and the missile. Tables 7, 8, 9, 10 and 11 summarize these properties.

Because of beryllium's high thermal conductivity, heat capacity, stiffness, melting point and strength-weight ratio, it is regarded as one of the most promising new metals in aircraft, missiles and space vehicles. Intense research is now under way to solve problems of ductility and others to speed the day of application.

High heat resistance and lightness are particularly necessary in spacecraft. AVIATION WEEK has estimated that it costs about $30,000 to put a pound of weight into orbit. This puts a very high premium on light metals that will not burn up at high re-entry speeds.

Norair Div. of Northrop Corp., which has developed beryllium extrusions for aircraft, surveyed 30 major aircraft firms in 1959 to determine potential uses for beryllium. Seventy per cent indicated that they intended to use large quantities of beryllium in the near future (five years or less). They specified $30 to $250 per lb as the cost range they were willing to pay for beryllium.

Studies have been made on the value of beryllium metal parts in aircraft and reported by George Hoffman of the Rand Corp. in MATERIALS & METHODS, February 1957.

Nuclear Applications

Beryllium is an excellent moderator to slow the speed of fission neutrons and also a reflector material to direct neutrons back into the core of a reactor. It can also be used as a can to hold uranium fuels in test reactors.

Table 8. Properties of Major Light Metals and Steel

	Density (lb /in.^{3})	Melting point (°F)	Modulus of elasticity (psi)	Tensile strength[a] (psi)
Beryllium	0.066	2350	40,000,000	40,000–80,000
Aluminum	0.100	1220	9,600,000	25,000–85,000
Magnesium	0.065	1202	6,500,000	24,000–52,000
Steel	0.280	2750	30,000,000	185,000–250,000
Titanium	0.165	3300	15,500,000	130,000–170,000

Source: BERYLLIUM, by Lawrence F. Boland, vice president, Beryllium Corp., Reading, Penna.

Table 10. Some Physical and Mechanical Properties of Beryllium Oxide

Specific gravity (single crystal)	3.025
Melting point deg F	4,658
Specific Heat (212° F)	7.7
(1450° F)	12.3
Vapor pressure, mm of Hg (3775° F)	1.8×10^{-3}
Thermal conductivity, btu/hr/sq ft/deg F/ft	90-115
Coefficient of thermal expansion per deg F (68° F-2550° F)	$5.1\text{-}5.2 \times 10^{-6}$
Volume resistivity, ohm-cm (RT)	10^{16}
(2200° F)	10^{12}
Dielectric constant (10^{-6} cups)	5.8
Tensile strength, psi (RT)	15,000
(2000° F)	8,000
Compressive strength, psi (RT)	150,000
(2000° F)	60,000
Transverse strength, psi	25,000
Modulus of elasticity, psi	43×10^6
Thermal absorption cross-section, barns	0.010

Source: BERYLLIUM, PRESENT AND POTENTIAL USES, Lawrence F. Boland, vice president, Beryllium Corp.

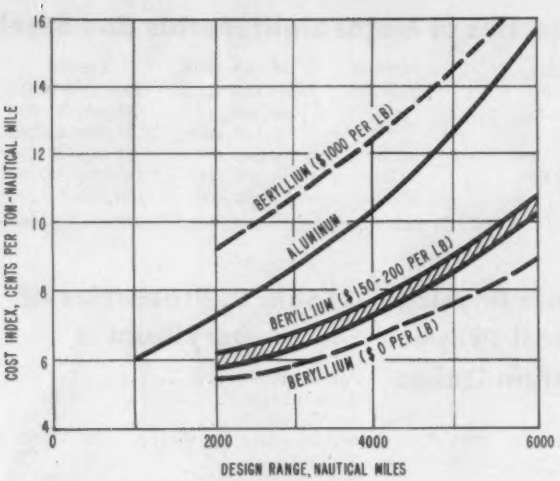
Table 9. Properties of Beryllium

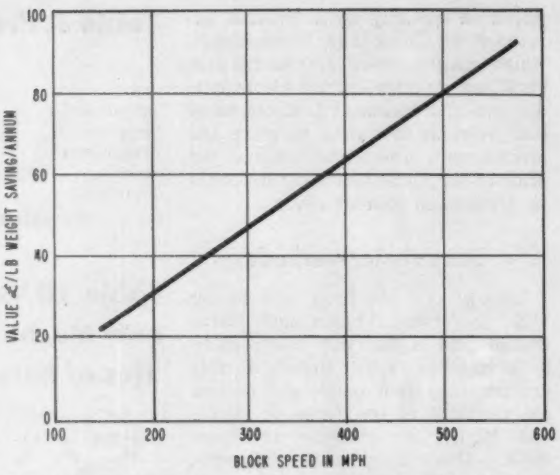
Atomic number	4
Atomic weight	9.04
Specific gravity	1.84–1.85
Melting point, deg C	1,284–1,300
Melting point, def F	2,343–2,372
Boiling point, deg C	2,970
Boiling point, deg F	5,378
Sp. heat, 30°-100° C (Cal per g/deg C)	0.475–0.516
Latent heat of fusion (cal/g)	250–275
Latent heat of vaporization (cal/g)	5,917
Linear coefficient of thermal expansion, 20°–200° C	$12.3\text{x}10^{-6}$–$13.3\text{x}10^{-6}$
Thermal conductivity at 20° C (68° F)	0.385 cgs
Electrical conductivity (% of Cu)	38.9–43.1
Reflectivity (white light) (%)	50–55
Velocity of sound (meters/sec)	12,600
Hardness (Brinell)	60–125
Tensile strength, psi	
Cast and extruded	36,000–55,000
Flake extruded	59,000–78,000
Proportional limit (psi)	
Cast and extruded	17,000–23,000
Flake extruded	20,000–30,000
Modulus of elasticity (psi)	$36\text{x}10^{-6}$–$44\text{x}10^{-6}$
Electrochemical equivalent (mg/coulomb)	0.04674

Source: RARE METALS HANDBOOK, Beryllium chapter by Bengt R. F. Kjellgren, Brush Beryllium Co.

Table 11. Beryllium Compared with BeO for Reactors

	Beryllium	Beryllium oxide
Melting point	2345° F	4658° F
Thermal neutron absorption cross section (Barns)	0.009	0.010
Hardness	B55-90	2000 Knoop
Density g/cc	1.85	3.025


COST INDEX, CENTS PER TON-NAUTICAL MILE
DESIGN RANGE, NAUTICAL MILES
BERYLLIUM ($1000 PER LB)
ALUMINUM
BERYLLIUM ($150-200 PER LB)
BERYLLIUM ($ 0 PER LB)



THE VALUE OF LIGHTNESS. Studies made by the Rand Corp. show ton-mile savings that could be made by substituting beryllium for aluminum at various prices for beryllium, ranging from $0 to $1,000 per lb. Source: MATERIALS & METHODS, Feb. 1957. Graph at right, compiled by the Society of British Aircraft Constructors, shows how much (in pounds Sterling) each pound of weight saved means to commercial airlines each year. For a plane travelling 300 mph block speed, the value per yr of one pound of payload would be about £46, or $129.26. Block speed is defined as the distance between start and finish of flight divided by elapsed time between doors open and doors shut. With savings of this magnitude, for each pound of weight saved, how much can aircraft manufacturers afford to pay for a metal which is about half the weight of aluminum? Seventy percent of aircraft makers queried said they are considering beryllium.

The Engineering Test Reactor (ETR), right, illustrates a 4½-in. thick beryllium reflector which surrounds the core. This reflector contains about 1,400 lb of type QMV beryllium (NUCLEONICS, March 1957). Table 11 compares the properties of beryllium metal with those of beryllium oxide, now also considered as an important material for reactor construction.

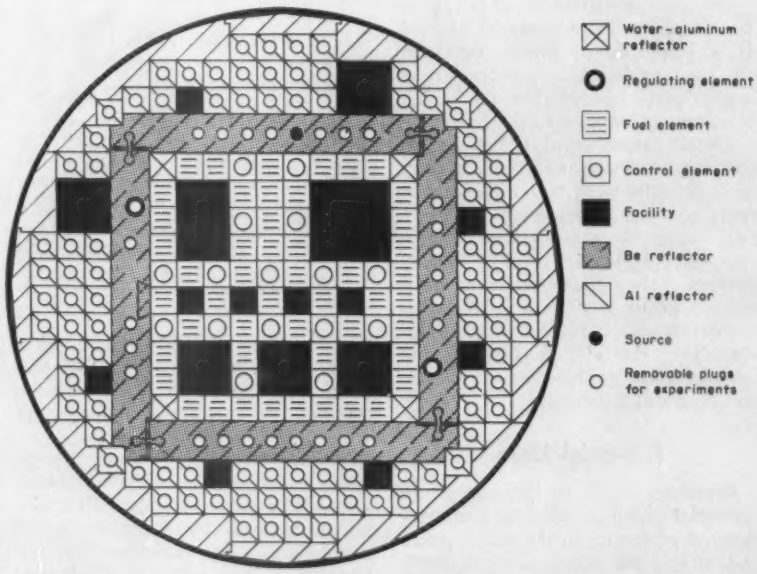
Alloys

Until recently, beryllium-copper alloys accounted for more than 80% of the end use of beryllium. They are vital to industry because of their high electrical and thermal conductivity, high resistance to corrosion and fatigue, stability under load, high strength, excellent castability and machinability. Copper containing 1.9% Be offers highest strength and hardness; 0.4% Be, high conductivity; and 1.2% Be, midway properties. Beryllium-copper is used in electrical contacts, springs, bellows, engine parts for aircraft, marine propellers, gears, bearings, precision castings and rollers.

Other beryllium alloys include beryllium-nickel alloys which resemble stainless steel in corrosion resistance, and beryllium-aluminum alloys which contribute to the thermal stability of aluminum. Many unusual combinations of metals requiring minor amounts of beryllium plus substantial quantities of copper, zinc or aluminum have been patented or are under investigation.

Beryllium oxide has a high melting point (Table 11), strength, hardness, stability at high temperatures, resistance to thermal shock and exceptional thermal conductivity. In addition to nuclear applications, mentioned previously, it is used in crucibles, as a refractory support in electrical heating equipment, for linings in induction furnaces, and for thermal radiation shields around crucibles. Beryllium product manufacturers hope to cut the costs of beryllium oxide shapes from current levels of $40 to $60 per lb to about half that for reflector and moderator parts in nuclear reactors. If

(Continued on p 192)



BERYLLIUM NEUTRON REFLECTOR in the Engineering Test Reactor (ETR) is 4½ in. thick. About 1,400 lb. of Brush QMV beryllium was used (Source: NUCLEONICS, March 1957). In 1951, Brush Beryllium completed a shipment of 6,000 lb of beryllium parts to be tested in the reactor at Arco, Idaho. Beryllium decreases hot spots in the reactor, decreases neutron leakage, decreases required fuel loading, permits running the reactor at a higher power level. Beryllium oxide is also a good reactor material because of its high thermal and low neutron capture properties.

AMC's Las Vegas Mining Show—
New Ideas From Key Men

PROGRAM

Monday, October 10

10:00 A.M. WELCOMING CEREMONIES; NATIONAL MINERAL POLICIES

Presiding: JOHN C. KINNEAR, JR., General Manager, Nevada Mines Div., Kennecott Copper Corp., McGill, Nev.; chairman, Western Div., American Mining Congress

Invocation: REV. WALTER HANNE, Presbyterian Church, Las Vegas

Placing of the Colors

Welcome to Nevada
HON. GRANT SAWYER, Governor of Nevada
HON. ORAN GRAGSON, Mayor of Las Vegas

Responses
RAYMOND E. SALVATI, president, Island Creek Coal Co., Huntington, W. Va.; president, American Mining Congress
OSCAR A. GLAESER, vice president & general manager of western operations, U. S. Smelting Refining & Mining Co., Salt Lake City; national chairman, program committee
ALBERT E. SEEP, president, Mine & Smelter Supply Co., Denver; chairman, AMC manufacturers division.
JESSE F. CORE, vice president-operations-coal, U. S. Steel Corp., Pittsburgh; chairman, AMC coal division.

Introduction of Distinguished Guests

J. C. Kinnear Jr.

A. E. Millar

General Chairman and Co-Chairman, Arrangements Committee

Presentation of "Certificates of Appreciation" to—
HON. JAMES E. MURRAY, U. S. Senator from Montana
HON. THOMAS E. MARTIN, U. S. Senator from Iowa
HON. JOSEPH C. O'MAHONEY, U. S. Senator from Wyoming
(Who are voluntarily retiring from Congress after long and distinguished careers—in recognition of their tireless efforts in furtherance of sound mineral policies.)

Chairman: HON. ALAN BIBLE, U. S. Senator from Nevada

The Minerals Platform of the Republican Party
A prominent official of the Republican Party

The Minerals Platform of the Democratic Party
A prominent official of the Democratic Party

Resolutions Committee Reports
General Policy
National Mineral Policies
Solid Fuels

MONDAY AFTERNOON

No Sessions—Entire Afternoon Open for Inspection of Exhibits

Tuesday, October 11

10:00 A.M. PUBLIC LANDS

Chairman: HON. WAYNE N. ASPINALL, U. S. Representative from Colorado

The Implications of Wilderness Legislation
RUSSELL H. W. CHADWICK, exploration engineer, Bear Creek Mining Co., Spokane
WILLIAM D. HAGENSTEIN, secretary, Resources Development Council, Portland, Ore.

Are Public Lands Contributing All They Should to Development of the West?
HON. ELMER F. BENNETT, Under Secretary of the Interior

The "Pre-Discovery" Problem
CHARLES F. BARBER, vice president & general counsel, American Smelting & Refining Co., New York

Problems Under the Multiple Use Laws
HON. EDWARD P. CLIFF, assistant chief, U. S. Forest Service
HON. EDWARD WOOZLEY, director, Bureau of Land Management

Resolutions Committee Reports
Public Land Policy
Water and Air Pollution

10:00 A.M. EXPLORATION AND GEOLOGY

Mineral Resources on the Ocean Floor
JOHN MERO, research engineer, Institute of Marine Resources, University of California, Berkeley

Metallogenic Maps of the United States
PHILIP W. GUILD, chief, base and ferrous metals branch, U. S. Geological Survey

How a Small Mining Company Can Pursue Mineral Exploration
KARL J. SPRINGER, mining exploration and development enterprises, Toronto, Ont., and Vancouver, B.C.

Geological Reconnaissance of Large Areas Leading to Economic Appraisal
E. E. THURLOW, chief mining geologist, Northern Pacific Railway Co., St. Paul

Part of the Committee that Arranged the Program

O. A. Glaeser
National Chairman

W. H. Love
Idaho

H. Z. Stuart
Eastern States

R. J. Linney
Lake Superior

E. D. Tierney
Montana

John Edgar
Washington

A Large Company and Worldwide Exploration
GLENN C. WATERMAN, chief geologist, Anaconda Co. (Canada), Ltd.

Discussion: EVAN JUST, chairman, department of mineral engineering, Stanford University

10:00 A.M. GENERAL OPERATING PROBLEMS

Freeport's Off-Shore Sulphur Property at Grand Isle, La.
PAUL D. BYBEE, general superintendent, Freeport Sulphur Co., Grand Isle, La.

Preliminary Engineering and Water Control for the Caland Operation at Steep Rock Lake
P. P. RIBOTTO, vice president, Caland Ore Co., Atikokan, Ont.

Use of Radio Communication in Small Mining Operations
ARTHUR W. WOODS, mine superintendent, Trace Elements Corp., Maybell, Colo.

Economics of Truck vs. Belt Haulage
PETER NALLE, superintendent of mining, Riverside Cement Co., Riverside, Calif.
D. M. COOPER, senior mining engineer, U. S. Borax & Chemical Corp., Boron, Calif.

2:00 P.M. TAX PANEL

Presiding: HON. THOMAS E. MARTIN, U. S. Senator from Iowa
HON. WALLACE F. BENNETT, U. S. Senator from Utah
HON. HALE BOGGS, U. S. Representative from Louisiana
HON. JAY GLASSMANN, special assistant to the Secretary of the Treasury
ELLSWORTH C. ALVORD, Alvord & Alvord, Washington, D. C.; tax counsel, American Mining Congress

Resolutions Committee Report
Taxation and Government Expenditures

3:00 P.M. INDUSTRIAL ENGINEERING SYMPOSIUM

Chairman: PAUL DASHINE, president, Calumet Div., Calumet & Hecla Inc., Calumet, Mich.

Survey of Industrial Engineering in the Mining Industry
R. M. STEWART, director, mining research, and S. W. HURLBUT, senior research engineer, Anaconda Co., Butte, Mont.

Discussion Speakers:
BENTON BOYD, manager, U. S. and Lark Mine, U. S. Smelting Refining & Mining Co., Salt Lake City
M. J. O'SHAUGHNESSY, assistant general manager, Nevada Mines Div., Kennecott Copper Corp., McGill, Nev.
CHARLES A. CLEEVES, assistant mine superintendent, Climax Molybdenum Co., Climax, Colo.
MEREDITH SMITH, staff manager of industrial engineering, International Minerals & Chemical Corp., Carlsbad, N. Mex.

2:00 P.M. SAFETY AND HEALTH

Radiation Control in Uranium Mining and Milling
ROBERT BEVERLY, Union Carbide Nuclear Co., Grand Junction, Colo.

Fighting Underground Mine Fires With Foam Producing Detergents
BERNARD W. CAREY, assistant superintendent, Pickands Mather & Co., Ironwood, Mich.

Blasting in Open Pit Mining for Maximum Safety
EMERY C. OLSEN, supervisor of mine inspection, Mines & Quarries, Columbia-Geneva Steel Div., Dragerton, Utah

Paul Dashine
Tuesday, 3:00 P.M.

R. M. Stewart
Tuesday, 3:00 P.M.

H. L. Hartman
Tuesday, 2:00 P.M.

E. P. Pfleider
Tuesday, 2:00 P.M.

Panel on Dust Control in Mining Operations

Moderator: E. P. PFLEIDER, School of Mineral Engineering, University of Minnesota

Panelists:

RONALD E. BALES, assistant chief, Occupational Health Field Station, U.S. Public Health Service, Salt Lake City

L. S. BERGER, U. S. Bureau of Mines, Washington, D. C.

HOWARD L. HARTMAN, Pennsylvania State University

FRANK J. LAIRD JR., assistant chief ventilation and industrial hygiene engineer, Anaconda Co., Butte, Mont.

2:00 P.M. OPEN PIT MINING

Reynolds' Open Pit Mining of Bauxite in Arkansas

JULIAN A. FULLER, superintendent of surface operations, and J. R. KRAUSE, chief engineer, Reynolds Mining Corp., Bauxite, Ark.

Maintenance of Open Pit Equipment

R. Y. JENSEN, assistant chief engineer, M. A. Hanna Co., Cleveland.

Discussion: CHARLES L. BOISE, assistant superintendent, Isbell Construction Co., Sahuarita, Ariz.

Economics of Large Tires for Earthmoving Equipment

G. E. DANBY, manager, sales department, Euclid Div., General Motors, Cleveland

Wednesday, October 12

MORNING

No Sessions—Entire Morning Open for Inspection of Exhibits

12:00 Noon LUNCHEON, BOARD OF GOVERNORS, WESTERN DIV., AMC

2:00 P.M. LABOR RELATIONS

Chairman: OSCAR GLAESER, vice president and general manager, U. S. Smelting Refining & Mining Co., Salt Lake City

The Labor Scene in 1960

HON. BARRY GOLDWATER, U. S. Senator from Arizona

A Practical Approach to Labor Relations

J. S. PARKER, vice president, General Electric Co., New York

Cooperation Between Labor and Industry

HON. JOHN H. DENT, U. S. Representative from Pennsylvania

Resolutions Committee Reports

Labor Relations and Labor Legislation

Mine Safety

2:00 P.M. UNDERGROUND MINING

Mining Huge Ore Bodies in Sweden

I. JANELID, professor of mining, Royal Institute of Technology, Stockholm, Sweden

Developments in Large Borehole Drilling

H. E. MAUCK, vice president-operations, Freeman Coal Co., Chicago, and D. C. RIDENOUR, general superintendent, Olga Coal Co., Coalwood, W. Va.

Inland Converts Drum Hoist to Koepe Friction Type for Greater Depth

J. R. GRONSETH, mechanical engineer, Inland Steel Co., Ishpeming, Mich.

Special Features of Hoist Installation at the Galena Mine

NORMAN VISNES, superintendent, Galena Unit, American Smelting & Refining Co., Wallace, Idaho

Slusher Operation in Narrow Veins

WILLIAM H. HARRISON JR., general mine superintendent, Aluminum Co. of America, Rosiclare, Ill.

2:00 P.M. MILLING AND METALLURGY

Chairman: R. R. MCNAUGHTON, manager, metallurgical division, Consolidated Mining & Smelting Co., Trail, B. C.

Instrumentation for Process Control in the Milling of Copper-Molybdenum and Potash Ores

GEORGE ATWOOD, vice president & general manager, and J. P. MCCARTY, Duval Sulphur & Potash Co., Tucson

Instrumentation of Plant Operations

R. G. PATTERSON, production manager, California Portland Cement Co., Los Angeles

The Krupp-Renn Direct Reduction Process

MAX KENNARD, vice president, Southwestern Engineering Co., Los Angeles

Developments in Autogenous Grinding

BUNTING S. CROCKER, vice president, Kilbourne Engineering Ltd., Toronto, Ont.

Plastics in Metallurgy for Resistance to Abrasion and Corrosion

WAYNE C. HAZEN, senior research engineer, Kerr-McGee Oil Industries Inc., Denver

Lawrence Litchfield
Thursday, 10:00 A.M.

S. H. Williston
Thursday, 10:00 A.M.

Thursday, October 13

10:00 A.M. STATE OF THE MINING INDUSTRIES

Chairman: HON. HOWARD CANNON, U. S. Senator from Nevada

Policies and Procedures of the Tariff Commission

J. ALLEN OVERTON JR., vice chairman, U. S. Tariff Commission

Nonferrous Metals

SIMON D. STRAUSS, vice president, American Smelting & Refining Co., New York.

Discussion: CLARK L. WILSON, chairman, Emergency Lead-Zinc Committee, Washington, D. C.

Iron Ore

C. F. BEUKEMA, president, Oliver Iron Mining Div., U. S. Steel Corp., Duluth, Minn.

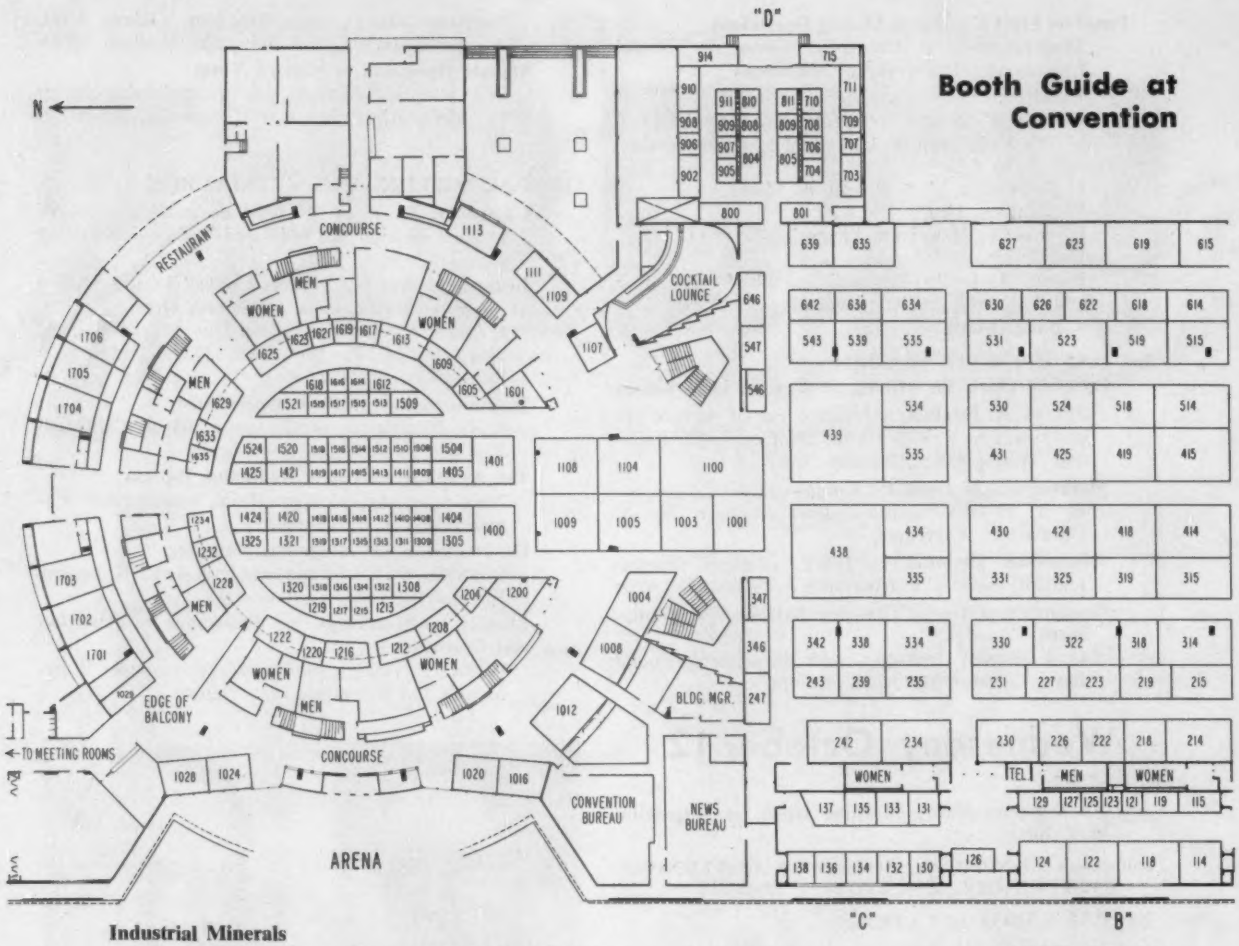
Light Metals

LAWRENCE LITCHFIELD, executive vice president, Aluminum Co. of America, Pittsburgh

Domestic Fuels (Coal and Uranium)

E. M. NAUGHTON, president, Utah Power & Light Co., Salt Lake City

(Continued on next page)



Industrial Minerals

BERNARD J. O'NEILL JR., geologist, department of earth sciences, Stanford Research Institute, Palo Alto, Calif.

Special Metals and Rare Earths

STEPHEN YIH, vice president & general manager, Wah Chang Corp., Albany, Ore.

Strategic Minerals

S. H. WILLISTON, executive vice president, Cordero Mining Co., Palo Alto, Calif.

Resolutions Committee Reports

Government Reorganization Mine Financing

10:00 A.M. UNDERGROUND MINING

Practical Use of Rock Mechanics

SETH D. WOODRUFF, civil engineering associate, Department of Public Works, City of Los Angeles

Alimak Raise Climber

B. R. WAPLES JR., chief engineer, Shattuck Denn Mining Co., Humboldt, Ariz.

New Drifting Methods at Britannia Mine

DONALD W. PRINGLE, manager, and HERBERT SHUTTLEWORTH, mine superintendent, Howe Sound Co., Britannia Div., Britannia Beach, B. C.

Underground Ammonium Nitrate Blasting

A. V. MITTERER and BEN T. PHILLIPS JR., International Minerals & Chemical Corp., Carlsbad, N. Mex.

An Application of Nuclear Detonations to Block Caving

WILLIAM FLANGES, superintendent of tunnels, Nevada Test Site, Mercury, Nev., and L. E. SHAFFER, professor of mining, University of California, Berkeley

10:00 A.M. OPEN PIT MINING

Open Pit Operations in the Gas Hills Area of Wyoming

ROY COULSON, superintendent, Vitro Minerals Corp., Riverton. Wyo.

Scientific Techniques in Control of Open Pit Slopes

ADOLPH SODERBERG, consulting mining engineer, Western Mining Div., Kennecott Copper Corp., Salt Lake City

New Developments in Initiation of Blasts in Mining

HARLAN J. POEL, manager, Technical Service Section, Explosives Dept., E. I. du Pont de Nemours & Co. Inc., Wilmington, Del.

New Developments in Ammonium Nitrate—Fuel Oil Mixtures for Blasting

D. M. STROMQUIST, technical representative, Coal Chemical Div., U. S. Steel Corp., Salt Lake City

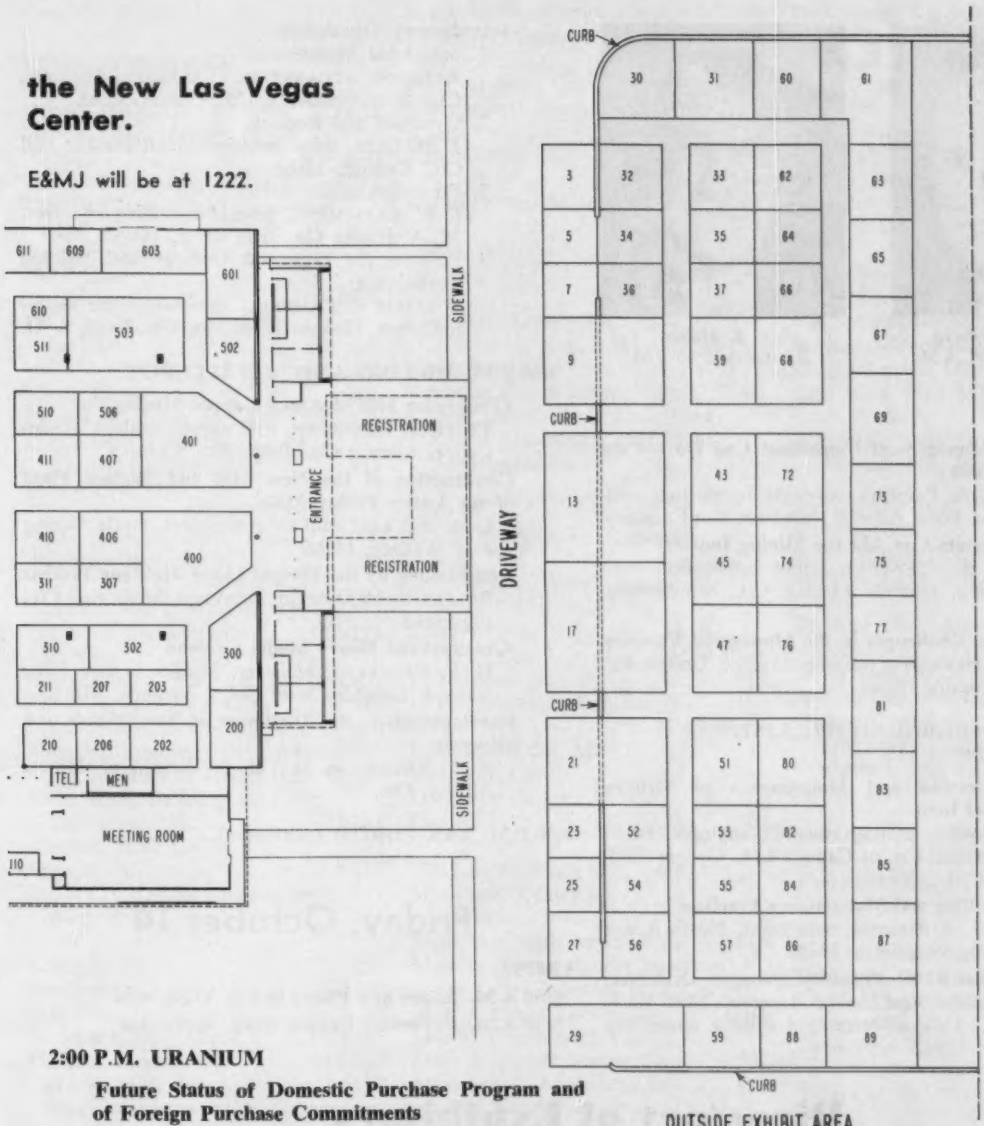
10:00 A.M. TAX FORUM

Chairman: LINCOLN ARNOLD, chairman, tax committee, American Mining Congress

Discussion of current tax problems of the mining industry—for accountants and others handling tax matters and all interested mining men.

the New Las Vegas Center.

E&MJ will be at 1222.



2:00 P.M. URANIUM

Future Status of Domestic Purchase Program and of Foreign Purchase Commitments

HON. LOREN K. OLSON, member, U. S. Atomic Energy Commission

Meeting World Power Needs for the Next Hundred Years

WILLIAM B. MURRAY, executive assistant to the president, Atomics International Div., North American Aviation Inc., Canoga Park, Calif.

Resolutions Committee Report

Uranium

3:00 P.M. GOLD, SILVER AND MONETARY POLICIES

Co-Chairmen:

H. B. JOHNSON, Sunshine Mining Co., Kellogg, Idaho

MERRILL E. SHOUP, president, Golden Cycle Corp., Colorado Springs, Colo.

Gold, Silver and Monetary Problems

DR. ELGIN GROSECLOSE, economist, Groseclose, Williams & Associates, Washington, D. C.

Discussion by Co-Chairmen

Resolutions Committee Report

Gold, Silver and Monetary Policies

2:00 P.M. MANAGEMENT TOOLS AND TECHNIQUES

Research Scientist, The Care and Feeding of

JACK W. DUNLAP, Dunlap & Associates, Stamford, Conn.

H. B. Johnson
Thursday, 3:00 P.M.

M. E. Shoup
Thursday, 3:00 P.M.

Adolph Soderberg
Thursday, 10:00 A.M.

F. J. Haller
Thursday, 2:00 P.M.

What the Management Consultant Can Do for the Mining Industry
SHERRILL A. PARSONS, coordinating partner-western region, Booz, Allen & Hamilton, San Francisco

How Computers Can Aid the Mining Industry
WALTER H. SCHWEDES, senior application engineer-Mining, General Electric Co., Schenectady, N. Y.

Changes and Challenges in the Managerial Function
W. PHIL HERRIOTT, training director, United Airlines, Cheyenne, Wyo.

2:00 P.M. UNDERGROUND DRILLING SYMPOSIUM

Testing, Selection and Maintenance of Drilling Equipment at Inco
J. H. DEWEY, drilling research engineer, International Nickel Co. of Canada Ltd., Copper Cliff, Ont.

Panel on Drilling and Maintenance Practices
Moderator: F. J. HALLER, consultant, North Range Mining Co., Negaunee, Mich.

Co-Moderator: R. W. PERSONS, manager, Drill Steel Div., Crucible Steel Co. of America, New York; chairman, AMC underground drilling committee

Introductory Discussions

1. Scheduled Maintenance
   RAYMOND STEWART, chief industrial engineer, Climax Molybdenum Co., Climax, Colo.
2. Overhaul and Repairs
   E. B. OLDS, mine superintendent, Bunker Hill Co., Kellogg, Idaho
3. Education of the Driller
   J. W. CLEMMENS, general operating engineer, M. A. Hanna Co., Iron River, Mich.
4. Pointers for Improved Underground Drilling Techniques
   WILLIAM C. CAMPBELL, assistant mine superintendent, Homestake Mining Co., Lead, S. D.

2:00 P.M. MILLING AND METALLURGY

El Salvador Mill of Andes Copper Mining Co.
PETER B. HOBSBAWN, mill superintendent, Andes Copper Mining Co., Potrerillos, Chile

Construction of the New Mill and Surface Plant of the Lucky Friday Mine
GORDON CRAIG, mill superintendent, Hecla Mining Co., Wallace, Idaho

Iron Making by the Dwight-Lloyd McWane Process
ROBERT C. MCDOWELL, president, McDowell Co., Cleveland

Gravity Feed Heavy Media Cyclone
H. F. KULLBERG, manager, Minnesota Ore Div., Jones & Laughlin Steel Corp., Virginia, Minn.

Developments in the Treatment of Rare Metals and Minerals
A. J. KAUFFMAN JR., U. S. Bureau of Mines, Albany, Ore.

2:00 P.M. TAX FORUM (continued)
(see above)

Friday, October 14

TRIPS

8:00 A.M. Mines and Plants in Las Vegas area

8:30 A.M. Kennecott Copper Corp. operations

Directory of Exhibitors

Acme-Hamilton Mfg. Corp 810
Aeroquip Corp., Western Div. .. 114
Alimak Corp. 1521
Allis-Chalmers Mfg. Co. 415-419-514-518
Allison Div., General Motors Corp. 1005
Alloy Rods Co. 800
Alloy Steel & Metals Co. 1213
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American Brattice Cloth Corp. .. 1219
American Cyanamid Co. 1024
American Manganese Steel Div., American Brake Shoe 235
Arcair Co. 704
Asea Electric Inc. 711
Atlas Copco Pacific Inc. 627
Atlas Powder Co. 1228
Automotive Hardware 1108

Baldwin-Lima-Hamilton Corp .. 619
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Bixby-Zimmer Engineering Co. . 1605
Boston Woven Hose & Rubber Co. 646
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Broderick & Bascom Rope Co. .. 1405
Brown Inc., David 1524
Brunner & Lay Inc. 1629
Bucyrus-Erie Co. 314
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Buffalo-Springfield Co. 57-86

Card Iron Works Co., C. S. 1325
Carrier Conveyor Div., Chain Belt Co. 601-603
Case Co., J. I. 210
Caterpillar Tractor Co. 315-319-325-331-414-418-424-430
Chain Belt Co. 601-603
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Chicago Pneumatic Tool Co. 33-62
Christensen Diamond Products Co. 1204
Clark Equipment Co., Automotive Div. 1003
Clark Equipment Co., Construction Machinery Div. 214-218-222-226-230
Clarkson Co. 1308
Climax Molybdenum Co., American Metal Climax Inc. 1513
Coast Mfg. & Supply Co. 1618
Colorado Fuel & Iron Corp. 1004
Columbia-Geneva Steel Div., U. S. Steel Corp. 407-411
Conveyor Belt Service Inc. 1215
Crucible Steel Co. of America 1421-1425

Cummins Engine Co. Inc. . .515-519

Davey Compressor Co. 55
Denver Fire Clay Co. 1520
Derrick Mfg. Co. 1633
Detroit Diesel Engine Div., GMC 511-610
Diamond Drill Contracting Co. .1614
Diamond Iron Works, Goodman Mfg. Co. 1001
Differential Steel Car Co. 81
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Intrusion-Prepakt Inc. 1029

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Joy Mfg. Co. 51-200-300

KW-Dart Truck Co. 425-425-431-524-530
Kennametal Inc. 642
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Le Roi Div., Westinghouse Air Brake Co. 21
Leschen Wire Rope Div., H. K. Porter Co. 1504-1508
LeTourneau Inc., R. G. 3-5-639
LeTourneau-Westinghouse Co. 37-39-66-68
Libu Shovel Co. AB 36
Link-Belt Co. 13-215
Longyear Co., E. J. 1212
Lug-All Co. 1220

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Propellex Chemical Div., Chromalloy Corp. 811

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Rees Blow Pipe Mfg. Co. 1612
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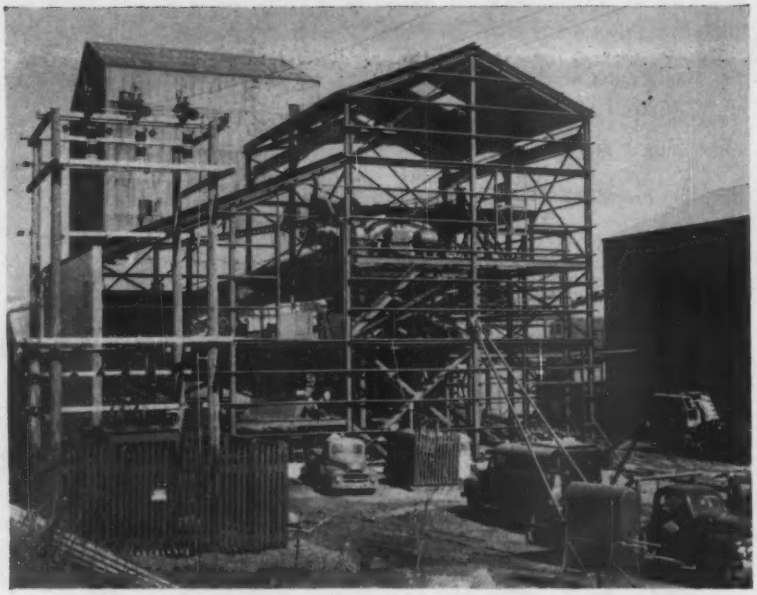


SECOND SCRUBBER, seen here during erection, is installed at Holman-Cliffs Mine, Taconite, Minn. This installation was a result of favorable results described here.

Mesabi Scrubber Helps Heavy-Media Performance

W. R. VAN SLYKE

R. C. FERGUSON

THE CLEVELAND-CLIFFS IRON CO. conducted the tests described below to check the advisability of scrubbing ore from its Canisteo Mine, near Coleraine, Minn. Test results led to the installation of a scrubber at Canisteo; and the Mesaba-Cliffs Mining Co. has installed another at its Holman Mine. Ten of the scrubbers on the Mesabi Range have been installed since the beginning of 1959, only one and a half years ago.

This technique, scrubbing, is becoming known as a valuable tool in upgrading Mesabi Range intermediate iron ores. Used with heavy-media separation on the right kinds of ore, it can raise the iron content and lower the silica content of final concentrates.

The Mesabi now has 18 scrubbers installed or planned. Twelve of these operate (or will operate) on what are best described as "painty" ores; and the other six on what is best described as siliceous material. With blast furnaces demanding better and better feeds, the trend toward a higher-grade product—scrubbing ahead of gravity concentration—may continue even further than it has already.

In general, the earliest washing plants included log-washers in their various flowsheets. Log-washers did impart a degree of scrubbing to the crude ore; but their action hardly resembles the type of scrubbing that is practiced today. When these early plants were erected, only the true "wash-ores" (which are defined as crude ores in which relatively coarse chunks of almost completely liberated iron occur in a matrix of loosely consolidated fine sand) were being processed. To treat these types of ore, sizing at approximately 65 to 100 mesh was enough to produce a merchantable concentrate.

Since crudes that were being treated had little "locking" of iron and silica, log-washers tended to disappear, and large screens and classifiers replaced them in Mesabi Range flowsheets. The "screening-and-classification" type of flowsheet had its greatest use in the 1945-55 period, generally speaking. During that period, many operators found that they had to supplement the "wash-ore" type flowsheet with heavy-media treatment also.

As intermediate crude-ore reserves, yielding a high-grade concentrate by the heavy-media process, were approaching depletion, blast-furnace operators at the same time began to demand a higher-grade furnace feed. By then, examination of many heavy-media plant feeds showed that, in many cases, scrubbing of the feeds would be helpful for two main reasons:

(a) "Painty" heavy-media feeds were being processed—feeds which generated considerable slimes in the heavy-media vessel. The slimes contaminated the circulating media, making it more viscous; this in turn led to an inefficient heavy-media separation. Since scrubbing removes slimes ahead of the heavy-media plant, a more efficient separation between ore and gangue results.

(b) Heavy-media feeds not containing any great degree of paint-rock were found to have a relatively soft, siliceous "scab" remaining on the ore particles after screening. Since the silica is generally softer than the iron, a sizable portion can be removed before heavy-media treatment. Scrubbing of such feed results in a "freer-separating" heavy-media feed, and thus a better separation.

Generally speaking, Mesabi Range heavy-media feeds may be divided into these two general types; although no plant will treat any one type exclusively.

Scrubbing of heavy-media feeds containing a fairly large percentage of paint-rock was first practiced in 1954. It is believed, however, that the 1957 scrubber installation, to be described here, was the first such unit installed mainly to treat siliceous ores to reduce silica content in over-all concentrate.

Most scrubbers preparing a "painty" feed will show a decided moisture reduction in over-all concentrates as one of their most desirable end results. With siliceous ores, on the other hand, moisture reduction is secondary; most important is to reduce the silica in over-all concentrates. The dissimilarity of the scrubber feeds, rather than any essential difference in how the scrubbers are operated, mainly causes this difference.

The Canisteo Scrubber

How the scrubber was introduced into the flowsheet of the treatment

Mr. Van Slyke is range metallurgist, Cleveland-Cliffs Iron Co., Taconite, Minn., and Mr. Ferguson is district manager, Hardinge Co. Inc., Hibbing, Minn. This article was originally presented as a paper at the San Francisco annual meeting of AIME, February 1959.

plant at the Canisteo mine is shown in Fig. 1.

Probably the entire plant crude could be scrubbed to obtain the same results. But to fit this scrubber into the existing plant layout, it was more convenient to proceed as shown.

When the unit started operating, in September 1957, the season was nearly over. In 1958, it operated for about six months, up to early November, and it operated from late April 1959 up to July 15, when the steel strike closed iron mines as well as steel plants.

A similar scrubber is being installed at a second property, and is operating during the 1960 season.

General Scrubbing Considerations

For a siliceous-type crude ore to respond favorably to scrubbing treatment, it must meet the following requirements:

(a) The siliceous gangue must be relatively more easily abraded than the iron particles.

(b) There must be a predominance of iron particles with loosely adhering silica attached.

It is obvious that if the two conditions are not met, scrubbing will not help very much.

Admittedly, these conditions restrict the types of crude which will respond to this type of treatment. But laboratory tests indicated that there existed a substantial tonnage of crude ore at Canisteo that scrubbing could benefit. An assay-recovery curve of a type of siliceous crude that scrubbing benefits substantially is shown in Fig. 2 (test no. 4, plus ½ in. fraction). However, Fig. 3 (test no. 11, plus ½ in. fraction) shows an assay-recovery curve for a type of siliceous crude which scrubbing does not help much.

Test work like this showed that scrubbing would be quite helpful on crudes mined from two of the company's properties. But it showed that it would not be advisable to install a scrubber at a third mine, mainly because condition (b) above does not apply, to any degree, to the crude ore now being processed there.

Test Data

Original laboratory test work was carried on on six samples, of about 10 tons each, from the Canisteo Mine.

Each sample was split into four fractions, according to this procedure: Dry screening rejected plus 5 in. material. Minus 5 in. was dry-screened on a 2-in. square screen. Oversize was crushed to pass 2 in., in a jaw crusher with opening set at 1¼ in. Crusher product was combined with 2-in. screen undersize. Combined product was wet-screened on ½-in. and ⅛-in. square screens. The ⅛-in. screen undersize was classified at approximately 65 mesh.

Thus four fractions—plus ½ in., minus ½ in. plus ⅛ in., minus ⅛ in. plus 65 mesh, and minus 65 mesh—were prepared. Representative samples of the two larger fractions were then tested with a ground-ferrosilicon suspension, at varying specific gravities. Samples of the third fraction (minus ⅛ in. plus 65 mesh) were tested in a 2.97 sp gr heavy-liquid. The minus 65 mesh material was rejected. The sink products were combined, to show what weight-recovery and concentrate grade could be expected on the unscrubbed material.

In the scrubbing tests, 200-lb representative samples of the washed product (plus 65 mesh) were placed in a cylindrical drum 20 in. in dia and 25½ in. in length (inside dimensions), into which had been welded 1½-in. angle iron lifters. This charge filled about 40% of the mill volume. Enough water was then added to bring the pulp to 75% solids by weight. Four separate charges were prepared, and the drum was rotated, at 45 rpm (about 76% of critical speed), for 3, 6, 10 and 14 min. The scrubbed product was removed from the mill, and given the same treatment as the minus 2 in. material described in the last paragraph.

Table I shows the results.

Generalized Scrubber Layout, Canisteo Mine, Cleveland-Cliffs Iron Co., Coleraine, Minn.

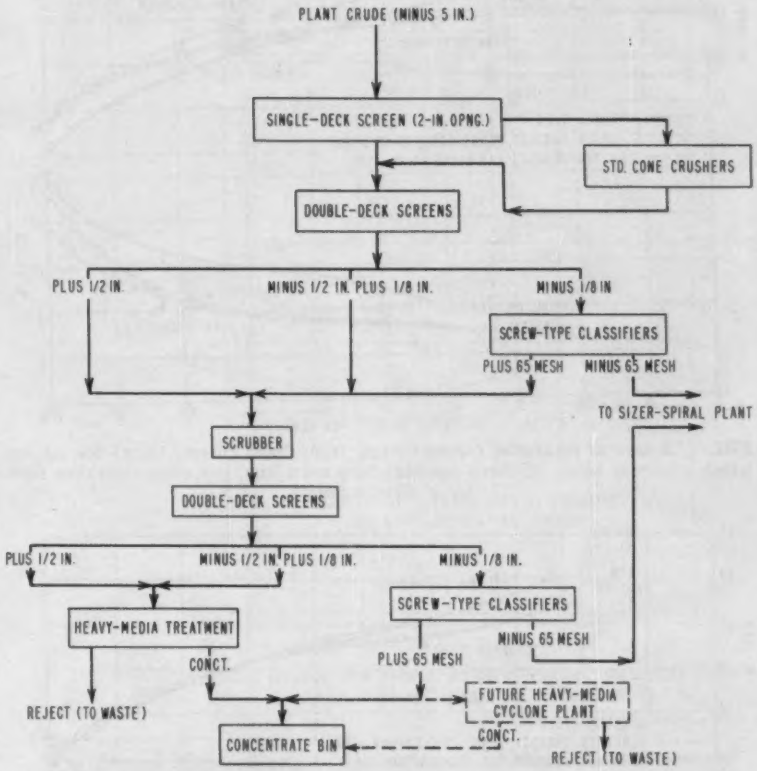


FIG. 1. FLOWSHEET OF THE CANISTEO SCRUBBER.

Scrubber feed is nominal minus 2 in., plus 65 mesh. Plus 2 in. material in plant crude is crushed in open circuit; crusher setting is 1¼ in. on open side. Crusher product, together with naturally-occurring minus 2 in. material, is screened and classified, minus 65 mesh fraction being removed. Plus 65 mesh material forms scrubber feed. Scrubber discharge is again screened and classified. Plus ⅛ in. fraction is sent to surge pile for subsequent heavy-media treatment. Minus ⅛ in. fraction is classified at 65 mesh in drag or screw-type classifier. Classifier product joins heavy-media concentrate and is sent to shipping bin. (At some future date, it will be necessary to extend heavy-media treatment to minus ⅛ in., plus 65 mesh fraction.)

Minus 65 mesh material from classifications before and after scrubbing is sent to combination sizer-spiral plant, to recover iron in minus 65 mesh, plus 150 mesh size range. Sizers are of rising-current, multi-pocket type.

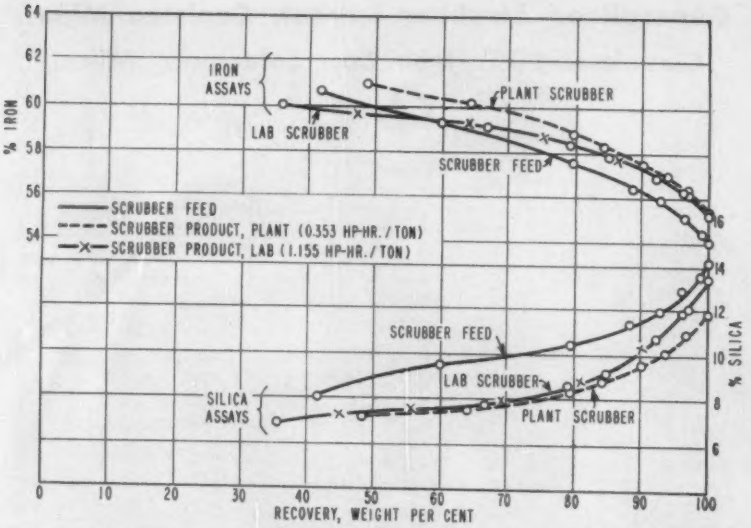


FIG. 2. Assays vs recoveries (upper curves: iron; lower curves: silica) for an ore which scrubbing helps. Scrubbed products have more iron, less silica, than does feed for a given recovery.

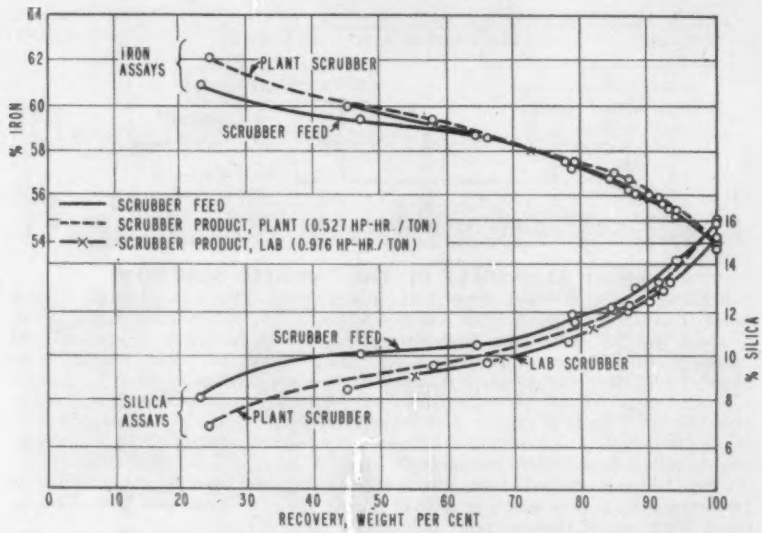


FIG. 3. Assays vs recoveries (upper curves: iron; lower curves: silica) for an ore on which scrubbing is not helpful. Here, for a given recovery, iron assay is not much higher, silica not much lower, for scrubber product than for feed.

Table I Results of Laboratory Scrubber Testing

Mine "A" (Avg. of 6 Samples)

Scrubbing time, min	% wt. recov., crude	% Fe	% SiO_2	% Fe unit recov.
0	48.41	56.72	11.23	71.79
3	43.37	57.55	9.87	65.26
6	43.14	57.93	9.31	65.33
10	41.20	57.97	8.89	62.43
14	40.63	57.88	9.05	61.49

These tests showed that the best scrubbing time was about 10 min (Figure 4, a graph of the data, also shows this: the grade improvement reaches its maximum at about 10 min of scrubbing time.) Watt-hour readings were taken to establish the amount of work done in 10 min on the scrubber charge. If other conditions remain constant, it follows that the amount of work done will vary as the size consist of the charge. Work input ranged from 0.731 to 1.039 hp-hr per ton; the higher figure was obtained from the scrubber feeds that contained the most plus ½ in. material (Table II).

Table II Work Input, Laboratory

Sample No.	Size consist of lab scr. feed: −2″ +½″	−½″ +⅛″	⅛″ + 65 m	Net work input in hp-hr/ton for 10 min. scrubbing
1	60	30	10	1.039
2	45	30	25	0.841
3	38	32	30	0.806
4	30	20	50	0.731

With these data in mind, it was felt that the commercial unit should do 0.7 to 0.8 bhp-hr of work per ton, to obtain the expected silica reduction in a large-scale plant. This was so because the structure shown by sample 3, Table II, was the average structure found for all scrubber feeds tested.

Operating Conditions

In an effort to duplicate the laboratory data in the field, a conical-type scrubber, 12-ft 6-in. in dia and 120 in. in cylinder length, and driven by a 500-hp motor, was installed at the point indicated in the flowsheet of Fig. 1. A sketch of the type of scrubber used is given in Fig. 5.

It was anticipated that the scrubber feed rate would equal 700 long tph, dry wt. This feed rate was not attained during the 1958 operating season, except for short intervals. Maximum tonnage, dry, of scrubber feed processed in an 8-hr period in 1958 was 712 long tph.

Table III Plant Scrubber Operation

	Max.	Avg.
LTPH Scr. Feed/8 Hr	712	540
Avg. HP-Hr/Ton, Work Done on Scr. Feed/8 Hr	0.725	0.509
Avg. Motor Brake Horsepower/8 Hr	457	379

Table III gives pertinent operating data on the scrubber operation.

These figures are for 8-hr averages. Tonnage and motor-bhp figures somewhat above these were occasionally obtained over short periods.

Because of day-to-day variations in size consist of scrubber feeds, maximum work done on the scrubber charge does not necessarily accompany maximum feed tonnage.

The divergence between average and maximum figures may seem incongruous to anyone who is not acquainted with the wide variations in size consist and concentrating characteristics that Mesabi Range intermediate-ore plants must handle. Such conditions must be anticipated in processing the ores; this was one reason for procuring a unit of such size.

Furthermore, the size consist of scrubber feeds may be expected to get coarser as ores approaching unaltered taconite are processed; and the percentage of plant crude reporting as scrubber feed may also be expected to increase. Both of these factors, as well as sudden variations in makeup of present scrubber feed, indicated that a larger unit than present conditions might indicate should be installed.

Using a pitot-static-tube and manometer to show the gallonage of water

Table IV Concentrate Data

	% wt. recov. crude	% Fe (dry)	% SiO_2 (dry)	Work input, net hp-hr/ton
Avg. of 12 Scr. Feeds	36.06	58.52	9.18	
Avg. of 12 Scr. Disch. (18 rpm)	34.85	59.09	8.32	0.504
Avg. of 12 Scr. Feeds Tested in Lab Scr.	33.19	59.07	8.50	1.049

Recap

	Plant Scr. (18 rpm)	Lab Scr.
Loss in % Wt. Recov.	1.21	2.87
Gain in Conct. % Fe	0.57	0.55
Reduc. in Conct. % SiO_2	0.86	0.68

(Above figures do not include sizer-spiral plant data.)

Table V Concentrate Data

	% wt. recov. crude	% Fe (dry)	% SiO_2 (dry)	Work input, net hp-hr/ton
Avg. of 9 Scr. Feeds	37.87	58.78	9.18	–
Avg. of 9 Scr. Disch. (18 rpm)	36.57	59.33	8.24	0.486
Avg. of 9 Scr. Disch. (12 rpm)	36.03	58.92	8.66	0.350
Avg. of 9 Scr. Feeds Treated in Lab Scr.	34.85	59.23	8.38	1.049

Recap

	Plant scr. 18 rpm	Plant scr. 12 rpm	Lab scr.
Loss in Wt. Recov.	1.30	1.84	3.02
Gain in Conct. % Fe	0.55	0.14	0.45
Reduc. in Conct. % SiO_2	0.96	0.25	0.80

(Above figures do not include sizer-spiral plant data.)

added to the scrubber feed, we tried to keep the solids in the scrubber feed at about 70%. The mill was operated at 18 rpm, or 80% of critical, except during short test periods. A recording wattmeter measured power input.

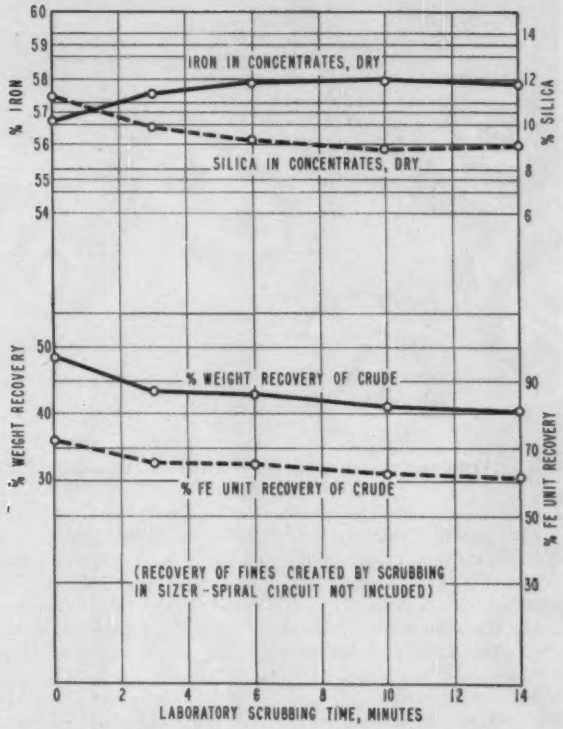

IRON IN CONCENTRATES, DRY
SILICA IN CONCENTRATES, DRY
% WEIGHT RECOVERY OF CRUDE
% FE UNIT RECOVERY OF CRUDE
(RECOVERY OF FINES CREATED BY SCRUBBING IN SIZER-SPIRAL CIRCUIT NOT INCLUDED)
% IRON
% SILICA
% WEIGHT RECOVERY
% FE UNIT RECOVERY
LABORATORY SCRUBBING TIME, MINUTES

FIG. 4. Grades and recoveries in laboratory scrubbing tests. Scrubbing time of 10 min yields best results.

Results of Operations

In all, 12 sets of samples from the plant scrubber were taken at intervals throughout the operating season. Samples of scrubber feed and scrubber discharge were taken concurrently. The scrubber feed sample was split into two portions. While one was evaluated unscrubbed, the other was scrubbed in the laboratory scrubber for 10 min.

In nine of the 12 tests, the character of the scrubber feed being processed remained constant. Thus a parallel sample of scrubber discharge could be taken after the scrubber had been slowed to 12 rpm, and time had been allowed for the scrubber charge to come to equilibrium at this lower speed. This sample of scrubber discharge was evaluated with other samples collected. All samples were processed in the same way as those in the laboratory scrubber testing.

Table IV gives the over-all results that were obtained.

Table VI Comparisons of Scrubber Feed and Discharge Structures, Average of 12 Tests

	Scr. Feed		18 rpm plant scr. disch.		12 rpm plant scr. disch.		Lab scr. disch.	
Screen size	% wt.	Cum. % wt.	% wt.	Cum. % wt.	% wt.	Cum. % wt.	% wt.	Cum. % wt.
+½"	49.69	49.69	37.96	37.96	43.14	43.14	42.49	42.49
−½+⅛"	29.06	78.75	26.23	64.19	26.05	69.19	24.69	67.18
−⅛"+65m	14.51	93.26	20.09	84.28	17.74	86.93	14.32	81.50
−65m	6.74	100.00	15.72	100.00	13.07	100.00	18.50	100.00
TOTAL	100.00		100.00		100.00		100.00	

Table VII Amount of Silica Reduction by Screen Sizes

	Sp. gr.	% wt. scr. feed or prod.	% wt. cr.	% Fe	% SiO_2	SiO_2 reduc.	% of total conc.
			+½" Fraction				
Scr. Feed	3.07	33.50	18.44	58.30	9.63	–	48.69
Plant Scr. Prod. 18 rpm.	3.06	27.24	14.94	58.32	9.18	0.45	40.85
Plant Scr. Prod. 12 rpm	3.05	29.98	16.43	57.90	9.35	0.28	45.60
Lab Scr. Prod.	3.08	30.82	17.00	58.18	9.46	0.17	48.78
			−½" + ⅛" Fraction				
Scr. Feed	2.78	22.24	12.27	59.12	8.41	–	32.40
Plant Scr. Prod. 18 rpm	2.81	21.43	11.81	59.54	7.42	0.99	32.29
Plant Scr. Prod. 12 rpm	2.79	19.69	10.86	59.25	8.33	0.08	30.14
Lab Scr. Prod.	2.79	19.86	10.96	59.82	7.51	0.90	31.45
			−⅛"+60 m Fraction				
Scr. Feed	2.97	13.00	7.16	59.44	9.37	–	18.91
Plant Scr. Prod. 18 rpm	2.97	17.80	9.82	60.63	7.79	1.58	26.85
Plant Scr. Prod. 12 rpm	2.97	15.83	8.74	60.42	7.76	1.61	24.26
Lab Scr. Prod.	2.97	12.81	6.89	60.91	7.13	2.24	19.77
			Over-all Data				
Scr. Feed		68.73	37.87	58.78	9.18	–	100.00
Plant Scr. Prod. 18 rpm.		66.47	36.57	59.33	8.24	0.94	100.00
Plant Scr. Prod. 12 rpm		65.64	36.03	58.92	8.66	0.52	100.00
Lab Scr. Prod.		63.21	34.85	59.23	8.38	0.80	100.00

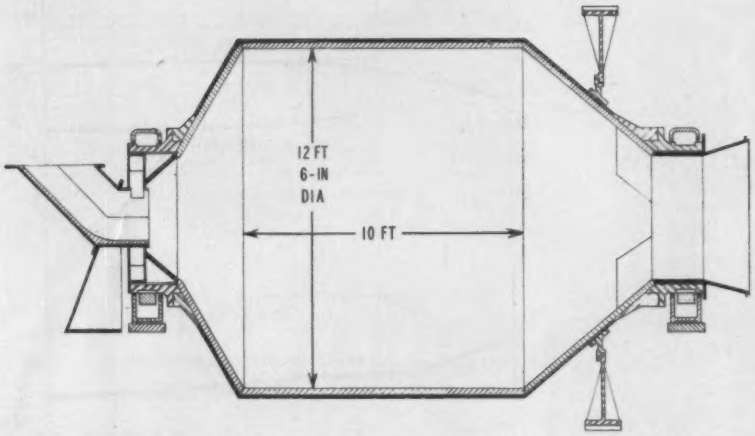


FIG. 5. Cross-sectional drawing of plant scrubber that was installed at Canisteo Mine. A 500-hp motor drives this scrubber.

The data in Tables IV and V show the concentrate grade that could be expected if heavy-media cyclone treatment of the minus ⅛ in., plus 65 mesh fraction were available. This plant's flowsheet does not provide this now; but such treatment will no doubt be available in the foreseeable future. Also, these are laboratory data; and gravity separations shown were made meticulously, as opposed to heavy-media separation in a large plant. Probably, silica values shown above should be revised upward by about two points to convert them to expected grades from actual present plant operations. Likewise, the iron values should probably be corrected downward by about 1.25 points, to go from indicated to actual plant data.

All samples of scrubber feeds and of various scrubber discharges were treated identically in this study. Therefore, the differences shown in Tables IV and V are believed to be a fair evaluation of how scrubbing affects the concentration of these types of iron ore. A full-scale plant does not operate as efficiently as a laboratory investigation; but this fact does not change the fact that scrubbing improves the subsequent heavy-media separations, as Tables IV and V show.

The original laboratory work showed that a work input of 0.7-0.8 net hp-hr per ton of scrubber feed would give the desired silica reduction. This compares with 1.049 net hp-hr per ton, shown in the laboratory scrubber tests on current plant-scrubber feeds. This is believed to be because the plant-scrubber feeds have a somewhat coarser structure, as opposed to the somewhat finer feed structure in the original laboratory work. Plant crushers were in open circuit, so that plant scrubber feeds were somewhat coarser than those of the original laboratory test work. It is believed this accounts for the difference in net work input done to yield a given silica reduction in over-all concentrates.

The test work showed that, to give the same silica reduction, the plant scrubber, operating at 18 rpm, needed only about one-half as much work, per ton of scrubber feed, as did the laboratory scrubber (0.504 net hp-hr per ton, vs 1.049).

No definite reason can be assigned why, for roughly the same silica reduction, there is such a large discrepancy in net work input. Table VI indicates that the discharge of the 18-rpm plant scrubber shows considerably less plus ½ in. material than does that of the lab scrubber. The plant scrubber also generates less minus 65 mesh material than does the laboratory unit. These are the most significant differences that the figures in Table VI show.

Table VII shows the amount of silica reduction by subsequent heavy-media separation, in various size fractions.

The plus ½ in. fraction accounts for 40-50% of the resulting over-all concentrate. It is in this size range that the plant scrubber, operating at 18 rpm, shows a silica reduction that is better than twice that of the lab scrubber, on the same material. Likewise, there is about a 30% greater silica reduction in the minus ⅛ in., plus 60 mesh fraction in the laboratory scrubber; but this size fraction accounts for only 20-25% of the total concentrate.

On ores of the type under test, it appears that a scrubber such as this, operated at high speed, can give equal or slightly greater over-all silica reduction, at less net work input than needed to obtain a comparable silica reduction in the small laboratory unit.

It seems apparent, from the data given in this paper, that scrubbing of Mesabi Range intermediate ores is valuable in trying to produce a more desirable furnace feed. There seems little disagreement on that score. By the same token, scrubbing of iron ore is relatively new, as it is now practiced; and authorities differ considerably as to how it can best be done. Since there is such variation in the types of ore whose concentrating characteristics scrubbing can improve, possibly no one scrubber design may give the best results under all conditions. As in many other beneficiating problems, it behooves the operator to undertake an adequate test program to determine what kind of scrubbing will most nearly solve his problems. On the basis of the material given here, this unit has performed satisfactorily, and it is expected that it will continue to do so.

The authors of this paper are indebted to Hardinge Co. Inc. and to the Cleveland-Cliffs Iron Co. for permission to publish this paper.

Coeur d'Alene Divers Find Lost 'Treasure'

TWO DEEP-SEA DIVERS have located in northern Idaho's Coeur d'Alene Lake what was believed to be a "treasure" in high-grade silver ore. The treasure, which was lost 70 years ago when a barge overturned on the lake, turned out to be not silver ore but lead concentrates worth perhaps $100 a ton.

The divers, Jack Ross and Dick Greer, found the concentrates near Sandy Point in about 100 ft of water. They had referred to old newspaper files at Wallace, Idaho, and consulted with mining company officials to get information on the lost treasure.

Some of the material had been recovered in salvage operations just after the barge went down. The ore came from the Bunker Hill mine in the Wallace area, and had been packed by burro to a boat landing at Cataldo, Idaho. Contained in ore bags, it was to be shipped to Spokane.

The two divers feel that recovery would be too costly to make it worth the effort. They said there is not nearly as much ore as was believed. They discovered the treasure July 10 after several days of probing the bottom of Coeur d'Alene Lake.

SINGLE-ROPE HOISTING saved an average of 30 to 40 seconds on each winding cycle as compared with twin-rope hoisting. Two single-rope hoists, used for mucking, provided a greater safety of operation and confined delays to one kibble.

Fast Shaft Sinking by Conventional Methods at El Akeba, Morocco

DR. -ING. K. HARTLAND

AN IMPRESSIVE PERFORMANCE in shaft sinking was made in the El Akeba copper mine in eastern Morocco last year. A 21-ft dia shaft was sunk 813 ft and 840.6 ft of permanent lining installed in a 29.66 day period using simple equipment. The advance per man-shift was 5.38 in. for sinking and 9.34 in. for lining. Careful planning and exacting implementation were responsible for the good results obtained—idle time amounted to only 0.01% of the total. The mine is owned by the King of Morocco and is state-operated. Sinking was accomplished by Surmere.

The shaft was sunk to a depth of 1908 ft. The excavation was fixed to a diameter of 21 ft and the open dimension after lining with a special brickwork was 18 ft. The strata intersected by the shaft were principally sandy shales (494.1 ft), sandy clay shales (154.5 ft) and sandstone (157.5 ft). The hardness coefficient varied between 3 and 4.5 tons per sq in. The strata were inclined in the shaft at 6° to 9° from north to south; inflow of water to the shaft was negligible.

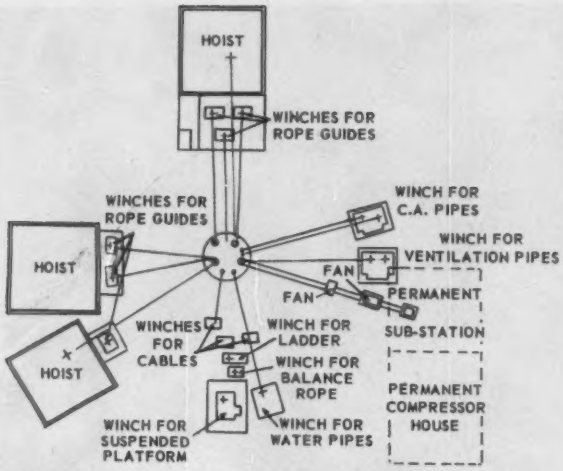
Dr. Hartland's address is Villa Mari-Loli, Carretera de Mijas, Fuengirola, Spain.

A 74-ft-high sinking derrick with legs 40.3 ft apart was erected over the shaft and contained three single-rope hoists—two with 70.6 cu ft buckets, the third with a 53 cu ft bucket. Fifteen winches were used to suspend the sinking equipment.

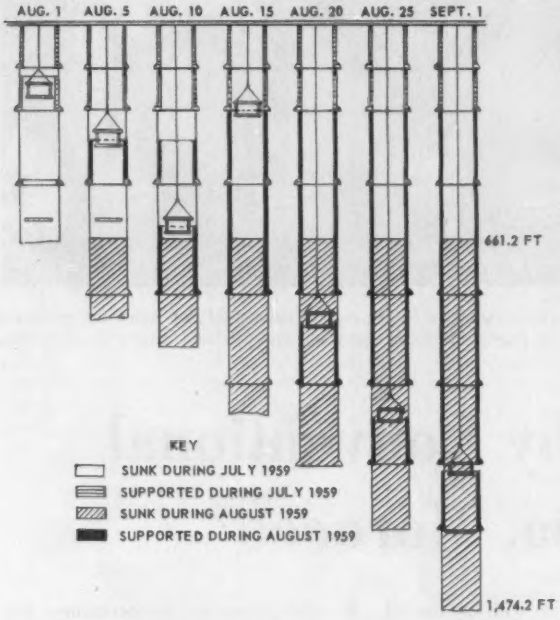
To allow sinking and walling operations to be carried on simultaneously, a two-deck steel scaffold suspended on a 1.5 in. rope was installed in the shaft. The two decks were connected by a rigid framework and spaced 12 ft apart. Work on the permanent lining was carried out from the lower deck; the upper deck served as a protective covering.

A tensioning frame, used also as a protective platform, advanced with the face and was fixed below the last walling curb erected. Three winches for the compressed-air loading grabs and four small hand winches for the side plum lines were installed on it.

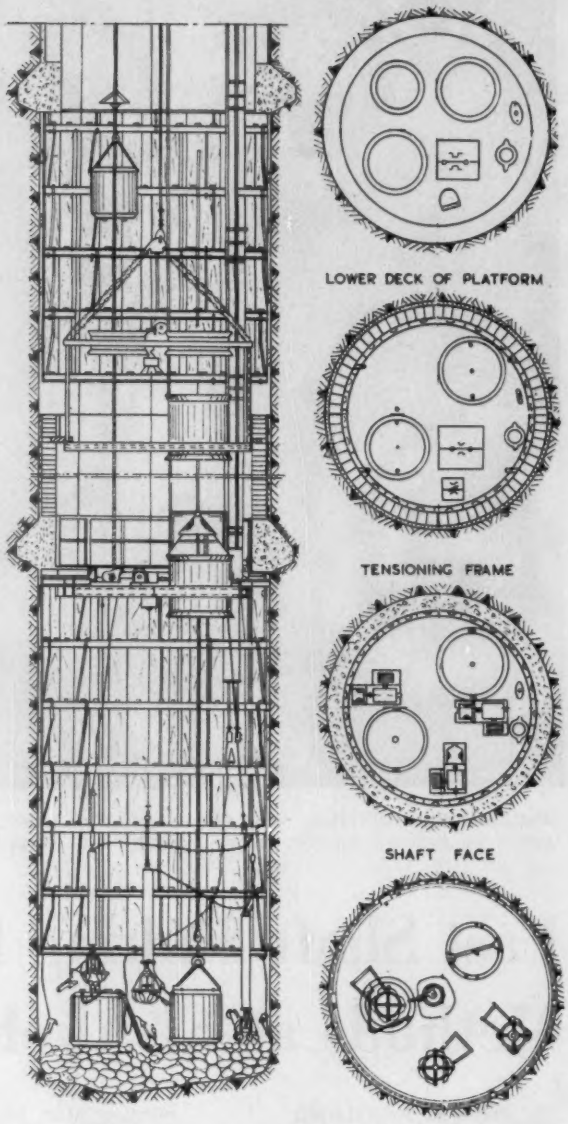
The 20-in. dia ventilation pipes as well as the 27.6-in. compressed air mains were each suspended by two ropes. Three 2-in. diameter high-pressure hoses connected an air manifold to the end of the compressed air main, and a winch on the suspended platform raised the hoses and manifold before shotfiring. As an important feature, a reserve of extension hose was kept on the tensioning frame platform and lowered by the winch on the



COMPRESSED AIR was supplied at a maximum of 9,000 cu ft per minute by 3 compressors installed in permanent house.



SINKING was accomplished by crews working four 6-hr shifts per day and completing four cycles per day.



THREE GRABS loaded each of two kibbles with 63.54 cu ft of material for each cycle to remove 1,285 cu ft per hr.

balance platform so that the main pipes had to be extended only when the platform was lowered to the next walling curb. Sinking was stopped while this was done. From the manifold, compressed air was taken to the loading grabs, drifters, pneumatic pics and winches by 1-in. dia hoses.

Single-rope hoisting saved an average of 30 to 40 seconds on each winding cycle as compared with twin-rope hoisting. Two single-rope hoists, used for mucking, provided a greater safety of operation and confined delays to only one kibble at a time. The winding capacity was calculated to exceed the loading rate of the three grabs.

The capacity of the three grabs was 4.77 cu ft each. The coefficient of grab utilization was 0.9 and the time for one grab operation, 0.6 minutes. The maximum hourly loading capacity was 1,285 cu ft.

Because it was believed that completing one cycle of operations per shift is the most advantageous method, a goal was set to complete four cycles by four shifts of six hours each per day. Lining also proceeded simultaneously with four 6-hour shifts. Thus the sinking personnel, totalling 96 men (60 for sinking and 36 for the erection of permanent lining) were split into 8 teams, each led by an experienced master-sinker. Fifteen men were included in each team engaged on sinking and setting temporary supports, and the teams employed on permanent lining consisted of 9 men each.

In addition 60 men were employed on the surface:

Shift fitters	4
Maintenance fitters	3
Banksmen	8
Shotfirers	3
Winding enginemen	9
Concrete mixers and assistants	18
Haulage workers	15

These surface men with the exception of the shift fitters worked an eight-hour shift. All men in each shift.

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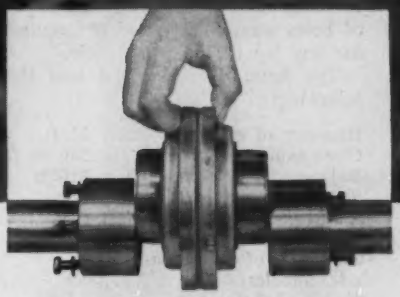

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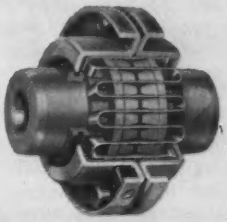

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both surface and underground, were under the charge of one of the four shift engineers; in addition one engineer was appointed to have charge of all machine maintenance and to supervise the fitters. The whole of the operation was managed by a chief sinking engineer.

To achieve the maximum sinking advance possible, the shifts were not changed for the month and work was carried out seven days a week. Production meetings were held each week to analyze progress and method of work. All men were thoroughly acquainted with the plan of operations, allotted tasks, work standards, wages and bonuses.

Drilling and Blasting

A fixed system for drilling and blasting was decided before sinking commenced in August. The drilling pattern, depth and number of holes were not varied for the different types of strata encountered. Only the depth of holes was to be varied to account for any lag in the work cycle.

The basic data assumed was the following:

Diameter of excavated shaft	21 ft
Cross section of shaft	346 sq ft
Sinking advance per month	810 ft
Sinking advance per day (shift)	27 ft (6.75 ft)
Sinking days per month	30
Coefficient of utilization of shotholes	0.9
Length of shotholes	7.5 ft

The optimum number of shotholes per sq yd was determined by experiment as 0.77, which meant 30 holes had to be bored. They were positioned around a central hole in circles with radii of 3 ft-3 in., 6 ft-6 in., and 9 ft-9in. The initial diameter of the holes was 2.05 in.; the final, 1.89 in.

Drilling was started during loading out, as soon as the periphery of the shaft was cleared. Two or three machines began drilling, but as the face was cleared, up to twelve were used. One and a half hours were allocated to drilling, the actual average time spent on drilling alone (when loading was finished) was only 30 minutes. The shaft was divided into various sections and each worker given a measured task both for drilling and charging the holes. Similarly for loading and temporary lining, working places and set tasks were alloted to every man.

After the grabs were raised about 60 ft from the bottom, the holes were thoroughly stemmed with sand-clay wads. Wires of the short-delay caps were connected to a pair of 14-gauge bus wires in parallel. After the crew left the bottom, the shift engineer and the senior shotfirer checked the wiring and connected the rounds to the surface-shotfiring cable.

The operating cycle was begun by removing a total of 4,203 cu ft of broken rock. The filling volume of the two 70.6 cu ft kibbles was 63.54 cu ft. Each of the two hoists required 33 winds and the grab capacity per hour was 1,285 cu ft. Three hours 55 minutes were allocated for loading out, but the average time, in practice, was 10 minutes greater, due to difficulties in thoroughly clearing the bottom.

The temporary support members consisted of steel rings made in six segments, which were connected by two pins at each joint. The rings were suspended on Z-shaped hooks and supported by cross bars made from 3-in. pipe, with one bar to each segment. The distance between the support rings was 5 ft. The rings were wedged in position in four places and adjusted to plumb lines; steel plates 3 x 5.2 ft were then inserted. The distance of the temporary supports to the shaft bottom never exceeded 7 ft.

Permanent Lining

Prefabricated concrete blocks that were horizontal, slightly wedge-shaped and built to a wall thickness of 16 in. were used for permanent lining. The third hoist ensured speedy delivery of materials, and disposal of rings and steel plates. Each bricklayer was allocated a certain section of the shaft and was held responsible for the quality and rate of work. The lining could be checked by eight plumb lines suspended from the last bricking curb. Although the required rate of walling was 6.75 ft per shift, the actual average rate was 7.5 ft. Advances of 9 ft per shift and more were common. Work was carried out on the permanent support for 28 days only, and 840.6 ft of shaft were walled.

Excavation for the walling curbs was made during sinking by boring about 20 shotholes, 4 ft long at 50°. These holes were fired with the bottom round and afterwards the support edge was dressed with pneumatic picks to the dimensions required. When the shaft bottom was another 105 to 180 ft from the curb, sinking was halted and the tensioning frame lowered and fixed under the first ring of the temporary support curb position. The tensioning frame was properly positioned and secured and a wooden flooring covered with asphalt paper and one inch of sand prepared. A metal shuttering, 3.5 ft high, was centrally positioned on the flooring.

The concrete for the reinforced walling curb was brought in from the working platform, then lowered and secured some 15 ft from the tensioning platform. A vibrator was used to ensure compaction of the quick-setting concrete. As soon as 8 to 10 in. of the curb was concreted, work on the shaft bottom recommenced. While operations for concreting the wall curbs were going on, ventilation pipes, compressed-air pipes, cables, etc., were extended and fitters had an opportunity to work on equipment in the shaft and on the surface.

Analysis of Performance

During August 1959 the El Akeba shaft was sunk 813 ft and 840.6 ft of permanent lining were installed. This represents a finished depth of 819 ft. Sinking was carried out between the depths of 661.2 and 1,474.2 ft for a period of 712 hours or 29.66 days. Thirty-two hours were spent in the course of the month on moving the tensioning frame and on the initial stages of erecting the walling curb. The frame was moved five times. The maximum extent over which the shaft was worked with only a temporary support was 192.9 ft.

Thus a total of 117 sinking cycles were completed, three less than planned, of an average duration of 6.09 hr. The 0.09-hr loss was, however, more than compensated by achieving an average cycle advance of 6.96 ft instead of the 6.75 ft planned. Naturally, the 117 cycles varied in duration—some were completed in as little as 5 hr 35 minutes and others over the planned time. Maximum consideration was given to completing one cycle in one shift. The idle time on an average was less than 0.01% and consisted of lighting faults, damaged high-pressure hoses, damage to grabs in shotfiring and extending of compressed-air pipes.

The average rate of sinking the shaft bottom was 6.96 ft per cycle, the maximum was 7.38 ft. Walling was carried out at an average rate per shift of 7.5 ft; the maximum was 10.4 ft.

Man-shifts spent on sinking totaled 1812 and man-shifts on permanent lining totaled 1076. Thus the advance per man-shift in sinking was 5.38 in. and for lining 9.34 in. The shaft was sunk to final depth in an over all time of five months, a remarkable figure especially in view of the simple equipment that was used to attain such a speed.

The equipment and technique used by Surmere, a French-German shaft-sinking firm, was similar to that used by the Russians in 1955 when they claimed a record of 663 ft of finished shaft during one month. However, the man-shift efficiencies of Surmere were greater than the Russians by 80% for sinking and 50% for walling.

It's Horse Sense . . . Why Chance Leaks in Seat Rings

Get Monel Seat BRONZE GATES made the way JENKINS makes them

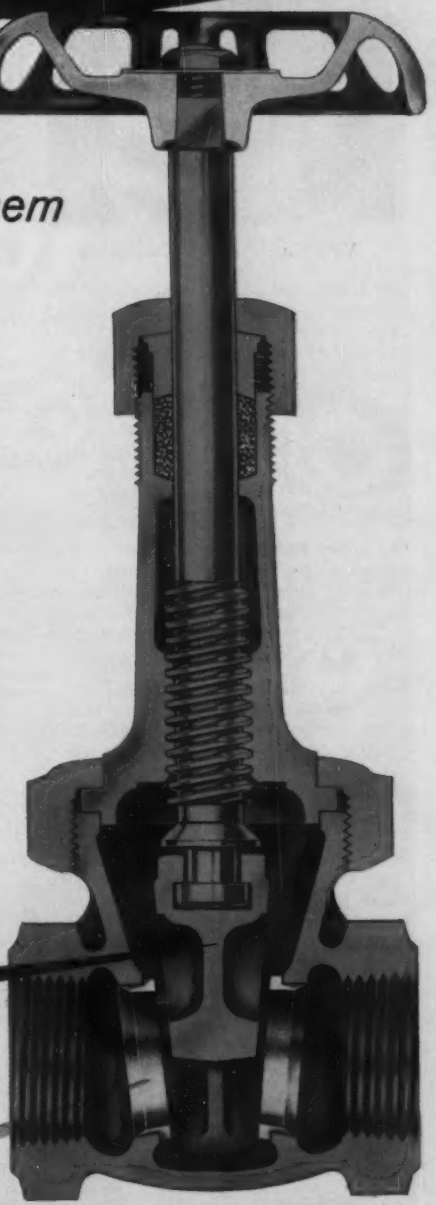
It's plain horse sense that you had better have the Monel seat rings EXPANDED (ROLLED) into the valve body if you want them to stay tight and leak-proof.

More horse sense . . . there's nothing valuable lost through having seat rings that can't be replaced by a regular maintenance man . . . **IF** the bronze or nickel alloy wedge has a lower degree of hardness than the heat-treated Monel seat rings. *(The way Jenkins makes them)* Then, the wedge takes the wear and seat rings are relatively unaffected.

Obviously, there's no faster, simpler or cheaper way to renew tightness and efficiency than to slip on a new wedge. And that, plus renewal of packing as needed, is all you need do to assure good performance from Jenkins Monel Seat Bronze Gates for as long as you'll need to care. Good service for scores of years is common.

Long, low-cost life also results from greater-than-ever-needed strength in every part of these valves. The records of millions of Jenkins Bronze Gates show you get full protection against all the stresses encountered in use.

Your local Jenkins Distributor will quickly supply your needs from a wide variety of Jenkins Bronze Gates. For information about these valves, write for folder No. 181-C. Jenkins Bros., 100 Park Ave., New York 17.



WEDGE is less hard than seat rings. Wear affects this easily replaceable part . . . NOT seat rings

SEAT RINGS are expanded (rolled) into body. Permanent, all-around support is essential to prevent deforming, loosening, shifting, LEAKS

JENKINS

LOOK FOR THE JENKINS DIAMOND

VALVES

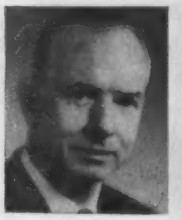
JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Distributors Everywhere

PERSONALS

Thomas R. Vaughan has been elected vice president and general counsel and **John C. Carrington** vice president of sales of Freeport Sulphur Co.

Vaughan, with the company since 1942, has been a vice president since



Vaughan

Carrington

1950 and was general counsel for the company's nickel activities. Carrington was elected vice president in 1952, after serving as director of public relations and assistant to the president.

James E. Quinn is now general sales manager for Denver Equipment Co. He has been serving as manager of the company's western division and has been in charge of the Uranium Processing Equipment Sales Div.

W. James Bichan, vice president of Canadian Engineering (International) Ltd., Montreal, is in the Republic of Korea in an advisory capacity to the government and as minerals consultant to the United Nations Special Fund.

John C. Douglas has been appointed vice president-operations and **David Swan** vice president-technology of Union Carbide Metals Co. Douglas has been with the firm since 1934 and has been vice president-technology since 1957. Swan joined UC in 1946 and was made manager-planning in 1959.

John J. Reed has accepted an appointment as professor of mining engineering at the Colorado School of Mines. He has spent the last five years in developing a mine research department for St. Joseph Lead Co.

C. V. Isbell has retired as president of the Isbell Construction Co. Also retiring are his brothers, **W. J. Isbell,** vice president; **Roy S. Isbell,** secretary; and **Guy V. Isbell, treasurer.**

Edward L. Pine is the new president and general manager with **Henry Isbell, Furman Byars** and **John Isbell,** vice presidents. **E. F. Duerr** is secretary-treasurer.

John A. Smrekar, supervisor of industrial relations at Reserve Mining Co.'s Babbitt mining operations, has been appointed supervisor of personnel services for the company. His successor will be **Russell A. Gilhoi.**

Dr. Allen T. Cole, minerals consultant, has been appointed property manager for the Florida and Tennessee phosphate operations of International Minerals & Chemical Corp.

Assisting Dr. Cole will be **W. A. Stringfellow,** reserves development engineer; **A. J. Hahn,** land reclamation engineer; and **Cecil Stange,** property superintendent. **J. R. Hall** will head the reserves acquisition program in the Tennessee field.

John P. Lacke, general superintendent of American Zinc, Lead & Smelting Co.'s Vinegar Hill Div. operations has been promoted to resident manager. **George A. Allison,** former assistant superintendent of the company's Dumas, Tex., division, is now general superintendent of the electrolytic division.

Dr. Stanley Grand has been appointed head of Vitro Laboratories' Chemistry & Arc Research Dept. He moves to his new position from Radiation Research Corp. where he was director of research and development.

James W. Kinnear Jr. has been named vice president—steel producing division, U.S. Steel Corp. Prior to his appointment he was executive vice president of the corporation's Tennessee Coal & Iron Div. **Oscar Pearson** is succeeding Kinnear in this position.

George H. Cleaver has left the ENGINEERING & MINING JOURNAL to become manager of market research for American Metal Climax Inc.'s Amco Div. He has been succeeded by **Jack O'Connell.**

Cleaver

O'Connell

Since 1953 Cleaver has been serving as market editor, a post that entails the editorship of E&MJ METAL & MINERAL MARKETS.

Formerly associate market editor, O'Connell joined E&MJ as assistant market editor in 1956.

S. E. Jerome, northwest district geologist for Bear Creek Mining Co., has resigned to enter a brokerage business in Salt Lake City. He also plans to work part-time with Hunting Geophysical Services Inc. He has worked with Gulf Minerals Co. and New Jersey Zinc Co.

Harold Powers has been named general superintendent of Hidden Splendor Mining Co.'s Rio de Oro Uranium Mine. Former assistant superintendent, he succeeds **Ray L. Schultz,** who is now vice president of See Tee Mining Co.

Dr. John S. Rinehart, director of the mining engineering research laboratories at the Colorado School of Mines, is making a two-month lecture tour of Europe under the sponsorship of the National Science Foundation.

Earl C. Van Horn has been elected chairman of the new Carolinas section of AIME. Vice chairman is **S. Duncan Heron** and secretary-treasurer, **Lewis J. Hush.**

A Wisconsin section of AIME has also been organized with **T. G. Kirkland** as chairman; **Dr. Richard A. Dodd,** first

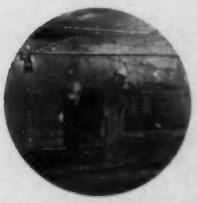
VISITING MEXICO MINING operations recently were (l-r) **Roger V. Pierce,** consulting mining engineer, **Alfred D. Wandke,** Latin America geological consultant, and **Marion Casper,** mining operator. The three men formerly operated together in Cuba. Last month Pierce also visited Toquepala, Cerro de Pasco's operations in Peru, Braden Copper Co. in Chile, and Anaconda Co.'s operations in Chile.

Study of specifications and detail engineering.

Excavation for shaft collar.

Completed 700' shaft, concrete lined.

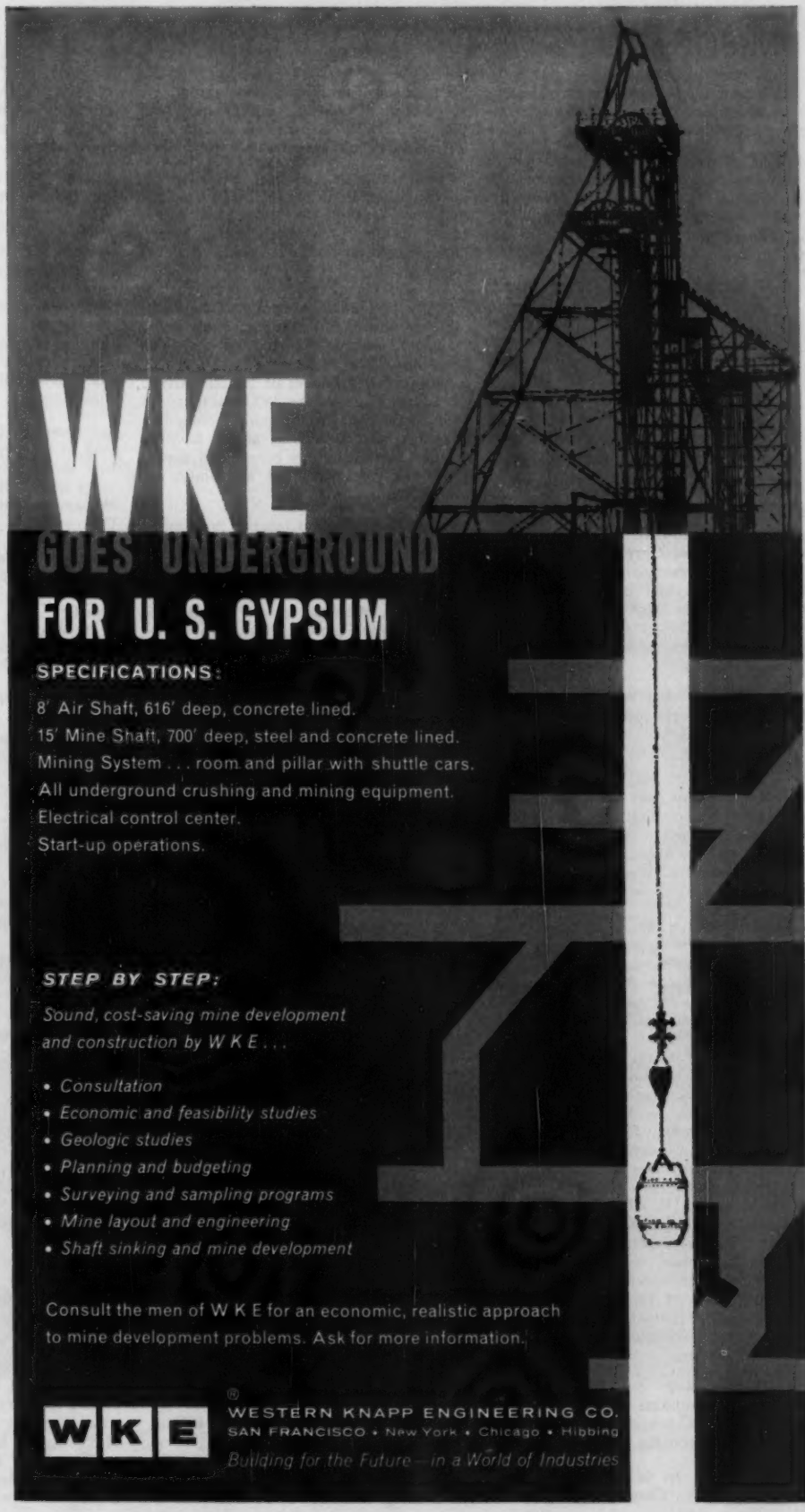
Crew readying for underground blast.



Underground control center.

Equipment lowered underground, readied for start-up.

Ready to go!


WKE
GOES UNDERGROUND
FOR U. S. GYPSUM
SPECIFICATIONS:
8' Air Shaft, 616' deep, concrete lined.
15' Mine Shaft, 700' deep, steel and concrete lined.
Mining System . . . room and pillar with shuttle cars.
All underground crushing and mining equipment.
Electrical control center.
Start-up operations.
STEP BY STEP:
Sound, cost-saving mine development and construction by W K E . . .
• Consultation
• Economic and feasibility studies
• Geologic studies
• Planning and budgeting
• Surveying and sampling programs
• Mine layout and engineering
• Shaft sinking and mine development
Consult the men of W K E for an economic, realistic approach to mine development problems. Ask for more information.
WKE
WESTERN KNAPP ENGINEERING CO.
SAN FRANCISCO • New York • Chicago • Hibbing
Building for the Future — in a World of Industries

PERSONALS (*Continued*)

vice chairman; **J. Walter Snavely,** second vice chairman; **John B. Calkins,** secretary; and **Edwin A. Sweetman,** treasurer.

Robert Henderson has been appointed vice president of Western operations for the Climax Molybdenum Co. Henderson was previously general manager of Western operations. He is president of the Colorado Mining Assn.

Henderson

Havas

George Havas has been appointed vice president and director of engineering of Kaiser Industries Corp. Associated with various Kaiser companies since 1928, he has served as chief engineer and vice president of the Henry J. Kaiser Co. and general manager of Kaiser's Heavy Construction Div. and the international subsidiaries.

Charles Lester Friedman has joined U.S. Borax & Chemical Corp. as a senior process engineer at the company's Boron, Calif., open-pit mine and processing plants.

Richard E. Cole has been named assistant manager at Reynolds Metals Co.'s Lawrence aluminum reduction facility. Cole previously headed the new industrial engineering department of the Reynolds Listerhill reduction plant.

J. Delano Hitch Jr. has resigned as chairman of the board of directors of Dorr-Oliver Inc. He will continue as a director and a consultant under long-term contract to the corporation.

Other reassignments at Dorr-Oliver include:

William J. Fox as vice president-domestic operations; **Douglas C. Reybold,** head of research, development, legal and patent functions; **H. J. Talbot,** managing director-Europe; **G. E. A. Schroth,** deputy director-Europe; **Harry E. Lundberg,** director-engineering.

Glenn O. Wilson, director-technical coordination; **Jack S. Chasteen,** manager-filtration engineering; **Charles A. Schreiber,** manager-engineering coordination; **Russell C. Raynor,** head of D-O's new sedimentation engineering division; **Philip B. Booth,** head of the reorganized general equipment engineering division; and **William A. Hirschfield,** manager—Fluo-Solids engineering.

Paul Elmon, who has been assistant supervisor at Neptune Gold Mining Co. at Bonanza, Nicaragua, has been appointed chief geologist.

L. L. Whitney Jr. is now with Union Carbide Metals Corp.'s Metallurgical Service Div. foundry service group. He has been associated with Inland Steel Co., American Steel Foundries and West Michigan Steel Foundry.

Birny Mason Jr. has been elected president of Union Carbide Corp., to replace **Howard S. Bunn** who was named to the new position of vice chairman. Mason had served as executive vice president since 1958.

Mason has served as president of Union Carbide Development Co., secretary of the parent company, vice president, a member of the appropriations committee and a director.

Bunn was president of Union Carbide Plastics Co. before his 1953 election to a vice presidency in the parent company. He has been a director and a member of the appropriations committee, executive vice president and a member of the executive committee.

Phillip Houseton has taken a position as geologist with Tri-State Zinc Co., in charge of exploration in the East Tennessee zinc district.

Judson H. Whitman is now assistant director in Michigan Chemical Corp.'s Rare Earths & Thorium Div. He has been mining engineer of the division.

John W. Cole has been assigned to serve as mining adviser to the Indonesian government, on loan from the U.S. Bureau of Mines. He recently resigned as exploration engineer for Sunshine Mining Co. to join the Bureau's division of foreign activities.

Eugene N. Hogan, labor commissioner for the Anaconda Co., retired July 1 after a career of nearly 50 years in the mining industry.

Daniel P. Griffin, personnel director for Butte operations, has assumed Hogan's duties.

With Anaconda since 1916, Hogan has worked as a contract miner, assistant mining engineer, sampler, safety engineer, assistant foreman and foreman of the Emma Mine, and assistant general superintendent of mines.

Raymond E. Corcoran has rejoined the staff of the Oregon Department of Geology & Mineral Industries after three years in bauxite exploratory work in the Willamette Valley for Harvey Aluminum Co.

John W. Chandler is the new manager of the mining department of American Metal Climax Inc.'s Mining & Exploration Div.

He succeeds **C. A. R. Lambly,** who resigned to become president of the Trout Mining Co.

Prof. E. P. Pfleider has replaced **Prof. S. R. B. Coke** as head of the School of Mines & Metallurgy in the Institute of Technology, University of Minnesota.

OBITUARIES

Eugene C. Grace, 83, former president and honorary chairman of the board of Bethlehem Steel Corp., died recently.

Having joined Bethlehem in 1899 as an electric crane operator, Mr. Grace had served as general superintendent of the corporation's Cuban subsidiary, Juragua Iron Co. and as general manager, vice president and president of Bethlehem Steel Co.

He became president of Bethlehem Steel Corp. in 1916 and in 1945 was appointed chief executive officer and board chairman. He retired in 1957, at which time he was named honorary chairman.

Interested in education and research, Mr. Grace initiated a program whereby Bethlehem pays privately endowed educational institutions $3,000 each for each graduate selected for the company's college graduate training course.

S. T. Harrison, 70, mining engineer of Clearwater, Fla., died July 30. A graduate of the Michigan College of Mining & Technology, he had been associated with the J. L. Sheily Co., St. Paul, Minn., for about 20 years.

J. Murray Riddell, 72, died in Houghton, Mich., July 13.

From 1945 to his retirement in 1956, he was with the mining department of the Michigan College of Mining & Technology. At his retirement he was made professor emeritus of mining engineering.

Mr. Riddell spent two years in Russia as a consultant under Russia's Five-Year Plan. He invented the Riddell shaft mucking machine which has been used extensively in the mining industry.

He had been associated with Consolidated Copper Co., Florence Iron Co., Buffalo Iron Mining Co., Corrigan-McKinney Steel Co., Republic Steel Corp. and E. J. Longyear Exploration Co.

James D. Warner, assistant superintendent at Oliver Iron Mining Div.'s Pioneer Mine, died July 19 from a heart attack.

Hans A. Vogelstein, 56, former president of American Metal Climax Inc. and president of the Commodity Exchange Metal Clearing Assn. Inc., died Aug. 6 at his New York home.

Mr. Vogelstein became Amax president in 1957 and retired last year because of illness. He had also served as secretary, director, treasurer and vice president of the metal company. From 1940 to 1957 he was a governor of the New York Commodity Exchange.

Bert C. Austin, San Francisco mining engineer, died in August. Born in gold mining country, Placer County, Calif., Austin graduated from the University of California in 1906. He was former president of Idaho Maryland Mines Corp. and a member of the state and the Governor's mining boards.

20 more for Toquepala!

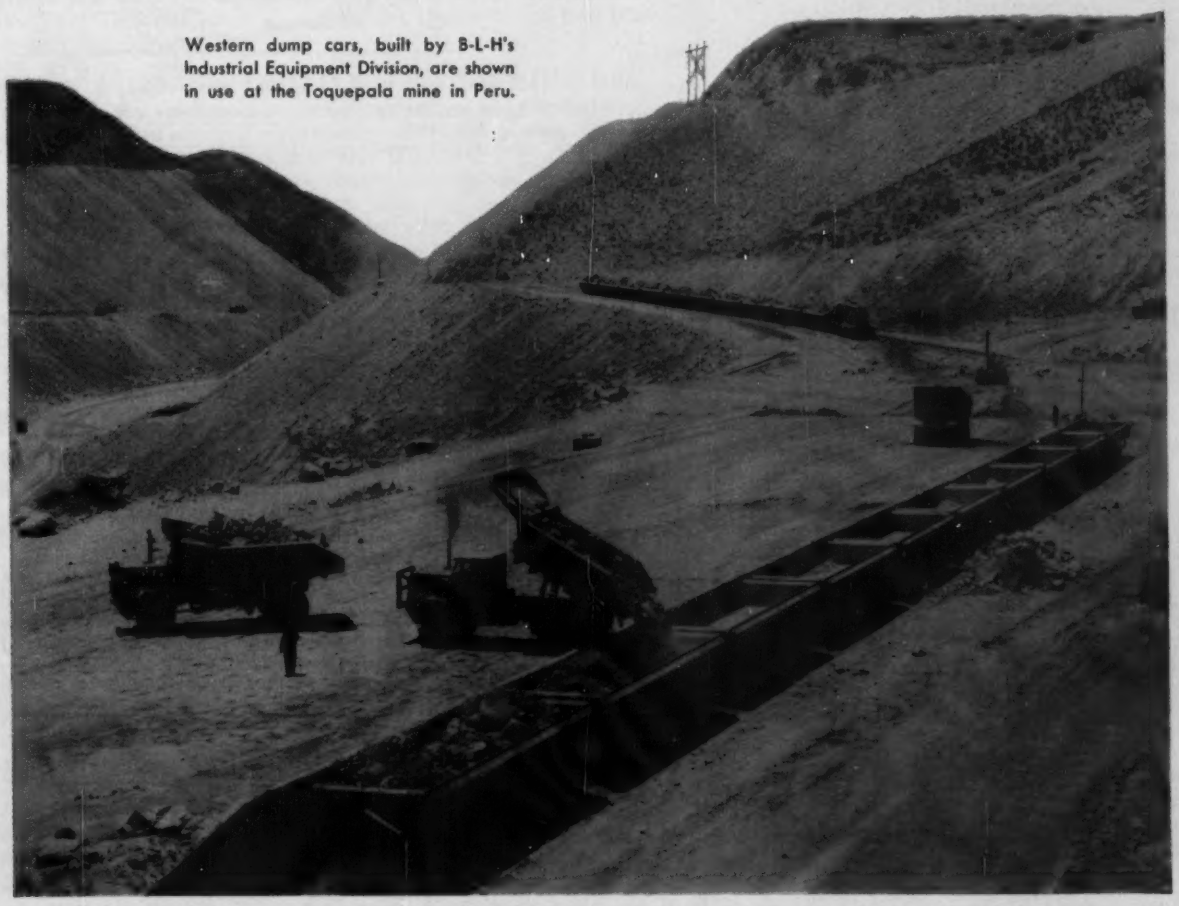
Westerns get the nod again for tough copper-carrying task

Last year, 85 air-operated Western dump cars went on the line at Southern Peru Copper Corporation's Toquepala project in Peru. Once more the durability of Westerns—heavy, dense copper ore calls for cars that can stand up under steady battering—was proved, and now B-L-H has been commissioned to supply 20 more. The new cars will be built of heavy gauge, double-reinforced steel. They will weigh 87,000 lb., measure 42 ft. by 11 ft., and have a level full capacity of 43 cu. yd., or 90 tons.

Among the specific features of Western dump cars that assure profitable operation are these:

- Door control mechanism, located at ends of car—substantial, fully enclosed, foolproof
- Exclusive dual side-pivots, permitting dumping with least effort and air consumption
- Fast-acting dumping mechanism and steep dumping angle to speed up operation, cut costs
- Automatic cut-off valve for smooth dumping
- Body underframe of one all-welded unit, heavily reinforced throughout
- Double-plate, curved-top door, strongest made
- Low center of gravity to assure stability in all situations

Built by B-L-H, Western dump cars are available in any size up to 60 cu. yd., any capacity up to 100 tons. Write us for complete information.

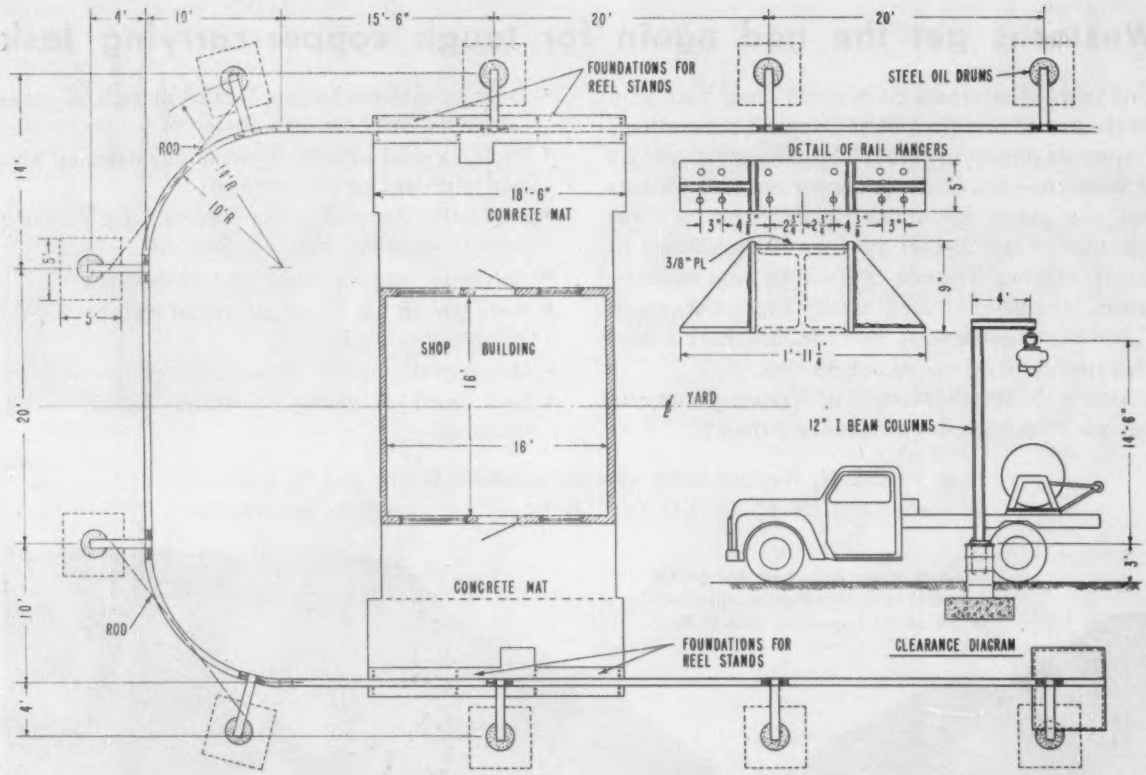


Western dump cars, built by B-L-H's Industrial Equipment Division, are shown in use at the Toquepala mine in Peru.

BALDWIN · LIMA · HAMILTON

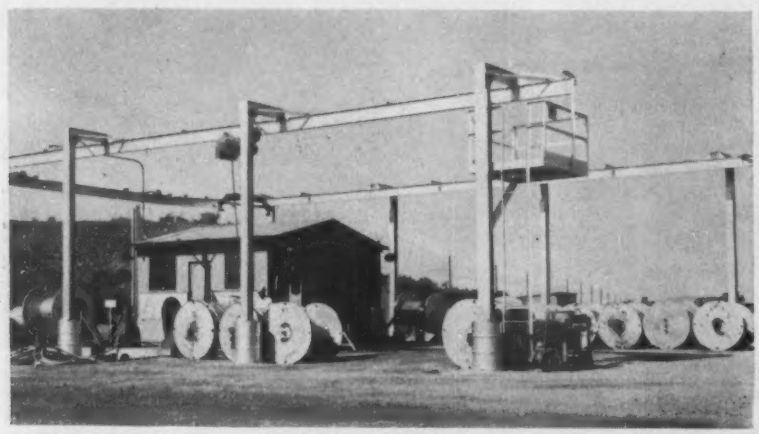
Industrial Equipment Division · Philadelphia 42, Pa.

OPERATING IDEAS



MINE CABLE REPAIR SHOP features mechanized material handling. Here the cables are spliced, vulcanized and tested.

A Modern Mine Cable Repair Shop



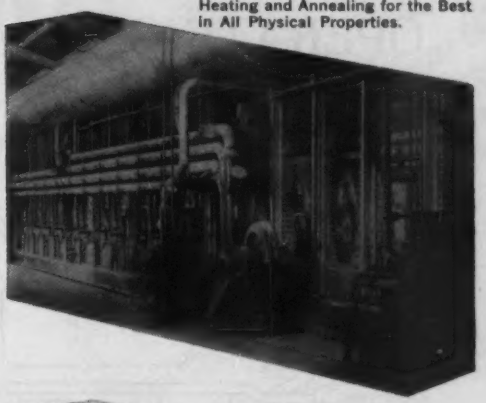
A 1-TON TELPHER HOIST on an overhead monorail lifts the cable reels from trucks. The reels are then rolled to the stands at the entry end of the building.

POWER CABLE MAINTENANCE COSTS have been materially reduced at the pit of Phelps Dodge Corp., New Cornelia Branch, Ajo, Ariz., by the installation at the mine of the modern cable repair shop shown. In the design of the new shop, the trend in mechanized handling of materials is well exemplified. All the latest improvements, both in equipment and methods, have been utilized to make inspection, repair and transportation of power cables on reels to and from the shop rapid and safe.

Details of the shop and yard layouts are explained in the above drawing. The shop building proper, a steel-frame structure, in which damaged points or sections of the cable are spliced, vulcanized and tested in a testing transformer unit, is in the approximate center of the yard area. Room is provided on one side of the building for future additions. The concrete mats at the entry and exit ends of the building accommodate two cable reel stands, each served by a motor drive to turn the reels mounted thereon whenever desired. This twin reel arrangement makes possible the passing of two cables through the shop at the same time. Both cables can be repaired simultaneously.

Considerable labor economy has been effected by the monorail, supported by H-beam columns, serving the shop building and yard. Reels with damaged cables brought in from the shovel points in the pit by truck are lifted from the truck by a 1-ton telpher hoist, rolled to the reel stands at the entry end of the building, and lowered into them. The reels holding repaired cables at the exit end of the building are lifted from the stands, rolled to the truck loading point, and lowered onto the truck. All steel units used in the construction of the shop building, monorail system and reel stands were made in the company machine shop.

Tunnel Kiln Firing With Controlled Heating and Annealing for the Best in All Physical Properties.



Serving Western Industries... Harbison-Walker Fireclay Refractories made in all classes at Ione, California plant

assure best service in every application

Produced in the commercial classes and various special modifications, these brands most economically fulfill every industrial furnace need for fireclay refractories. They meet the A.S.T.M. specifications with an added margin of quality.

Basic factors of paramount importance in the manufacture and use of these unsurpassed fireclay refractories are unexcelled quality of clays, sustained research, modern manufacturing facilities including the benefits of long experience and best skills, rigid quality control and technical assistance in all applications. The following significant analogies serve in making the choice of the best brick for various particular uses.

how ZENITH (superduty) compares with high-duty fireclay brick

In refractoriness, resistance to corrosion by fluxes and thermal shock, high temperature strength and stability of volume in soaking heats, ZENITH is measurably better than high-duty brick.

In cold strength, thermal expansion and thermal conductivity, ZENITH is similar to high-duty brick.

In porosity, permeability, slag penetration and basic oxide content, ZENITH is lower and better than most high-duty brick.

WESTERN high-duty fireclay brick... power pressed

Among the best high-duty fireclay refractories, the quality of WESTERN brand is maintained on the high side of the average—in refractoriness—physical strength in soaking heats—constancy of volume at high temperatures and spalling resistance.

WESTERN T high-duty fireclay brick... extruded

WESTERN T in the class of high-duty fireclay brick made by the extrusion method, possesses enhanced properties of low porosity and permeability by slags, abrasion resistance and high strength.

AMADOR medium-duty fireclay brick... power pressed

AMADOR is the power pressed, medium-duty companion to these brands of special merit. In various rectangular sizes it is second to none in workmanship. It complies with the A.S.T.M. classification by a liberal margin.

MORTARS

All corresponding mortars are available for every requirement in the use of these brands.

MONOLITHIC REFRACTORIES

Available also are the Harbison-Walker castables, plastic firebrick and ramming mixes of all kinds—balanced for the selection of the most serviceable product for each particular need.

HW 60-18

Harbison-Walker Refractories Co.

and Subsidiaries

West Coast Offices: San Francisco 5, Calif. Los Angeles 22, Calif.

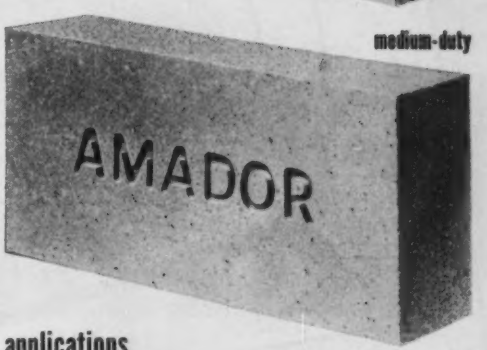
General Offices: Pittsburgh 22, Pennsylvania

World's Most Complete Refractories Service

superduty

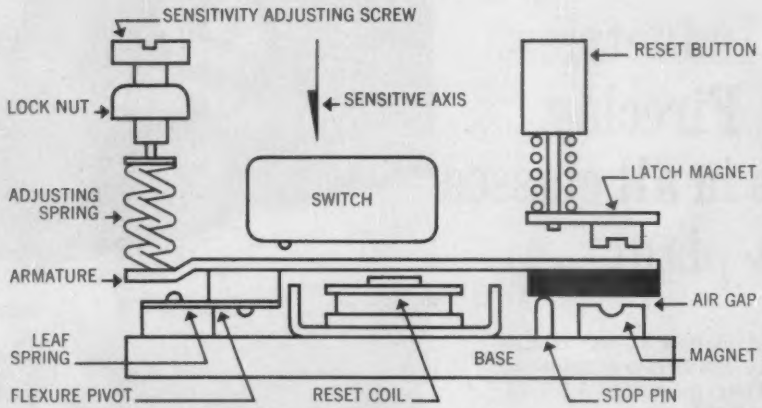
high-duty

medium-duty



applications

From these brands can be selected those best suited for specific operating conditions. Some typical uses in which they serve with splendid results are the following: • Boiler Furnaces • Ceramic Kilns • Cement and Lime Kilns • Chemical Plant Requirements • Cupolas • Electric Furnace Roofs • Heating Furnaces • Metallurgical Furnaces • Petroleum Refining and Petrochemical Furnace Equipment • Regenerators and Checkers of Glass and Steel Furnaces • Steel Plant Mill Brick Needs • Blast Furnace Stoves and Piping • Carbon Electrode Baking Furnaces



WHEN PEAK ACCELERATION exceeds a pre-selected level, the armature leaves the stop pin and moves up until it strikes the latch magnet, actuating the switch.

Vibration Detector Prevents Mill Damage

IF YOU WANT TO STOP your centrifugal impact mills before they break down, use an automatic malfunction detector—a device that measures vibrations. Should foreign matter be accidentally introduced at intake points, the detector will automatically shut the mill down and signal an alarm. Quick shutdown prevents excessive damage resulting from the rotor weight and high operating speeds of the mills.

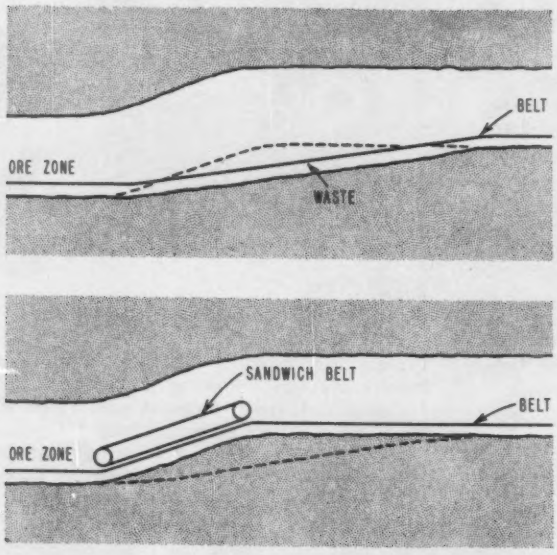
A sensitive detector, the Vibraswitch, is illustrated here. It is said to be able to measure small amplitude noises that are not measurable with conventional displacement vibrometers. Sensitivity of the device increases with frequency, making it equally suitable for sensing either increases in amplitude at the operating speed, or the high frequency chatter, noise or shock associated with many types of malfunctions. Complete equipment protection is thereby attained.

At a South American asbestos mine, the device was tested on a mill containing a 600-lb, 40-in. rotor equipped with special impactors. The mill produced impact velocities in excess of 30,000 fpm. Incorporated as original equipment, the detector automatically shut down the mill when burlap sacking became enmeshed in the main rotor during high speed operation and prevented extensive damage to the machine and other nearby equipment.

The device employs a magnetic circuit opposed by inertial and adjustable spring forces in the actuating mechanism. The armature is constrained to only one type of movement by a frictionless flexure pivot composed of two overlapping blocks and a leaf spring loaded in one direction to hold the blocks together. The armature rocks on the pivot—being forced in one direction by the adjusting spring and the other direction by the magnet.

When the entire assembly is subjected to vibration perpendicular to the base, the peak acceleration times the effective mass of the armature produces an inertial force which, aided by the spring's force, pulls the armature away from the stop pin and opens the air gap. When the peak acceleration exceeds a pre-selected level, the armature leaves the stop pin and moves up until it strikes the latch magnet, actuating the switch during the upward travel.

The Vibraswitch, manufactured by the Aeronautical & Instrument Div., Robertshaw-Fulton Controls Co., Anaheim, Calif., may be reset by depressing the reset button or applying power to the electrical reset coil. It provides protection for large motors, pumps, fans, compressors and other rotating and reciprocating equipment, sensing failing bearings, bent shafts, broken or over-burdened blades, overspeeding and similar malfunctions that cause increased unbalance or high frequency vibration. Designed for low-maintenance service in permanent installations, it may be wired to actuate an alarm, cause shut down, or start stand-by equipment.



Steep Conveyors Suggested For Mine Haulage Drifts

TO MOVE ORE DIRECTLY UP-DIP in steep haulage drifts, use a sandwich belt on your conveying system.

Such a belt will permit a theoretical maximum angle of inclination of 45° and should be economical when (1) the cost of removing waste exceeds the cost of a sandwich belt (as illustrated to the left) or (2) steep dip angles prohibit the use of conventional conveyors.

In the mill, sandwich conveyors could be used where space limitations prohibit the use of conventional inclined conveyors.

Sandwich conveyors are reported in use in a South African coal plant and on bucket wheel excavators. They handle large tonnages and use smooth troughed belts. Poorly sorted material, containing large boulders are apparently no problem. Wet material can also be successfully conveyed with the system.

The design of sandwich conveyors will be featured in a future issue of E&MJ. For each proposed use of the system, a careful economic analysis will be necessary.

1956!

EXTRA MINING CONGRESS CONVENTION

KW-DART SHOWS 35SL

KW-DART TRUCK Co., Kansas City, Mo., steals the show with the first single axle, 35 ton, rear end dump truck. Powered by a 400 H.P. engine, 3-stage converter and 3 speed transmission, this new KW-DART promises to be a revolutionary step forward in mining and construction operations. It's rugged with KW-DART'S 110,000 pound planetary drive axle and 50,000 pound tubular front axle. Gross vehicle weight is 131,600 pounds. Superintendents enthusiastic!

1958!

EXTRA MINING CONGRESS CONVENTION

KW-DART DOES IT AGAIN!

This year KW-DART shows the new model 50T—a sensational new 50 ton, 600 H.P. truck with tandem rear planetary axles of 100,000 lb. capacity each. This truck will provide power for the climb and speed for the haul road with 3-stage converter and 4-speed transmission, 50,000 pound capacity front axle. Gross vehicle weight is 188,000 pounds.

What will KW-DART show at the Mining Congress Convention in 1960?

EXTRA MINING CONGRESS CONVENTION

ANOTHER FIRST FOR KW-DART!

As in past years, KW-DART is introducing a revolutionary new haulage concept in the mining industry. The new KW-DART being shown is a new design, single axle with more [illegible] than ever used before. Utilizing a tractor [illegible] combination, it has the biggest payload capacity [illegible]—carrying [illegible] tons

KW-DART TRUCK CO.®

1301 North Manchester Trafficway
Kansas City 41, Missouri, U.S.A.

NEW BOOKS

Industrial Minerals and Rocks. This completely revised volume, regarded as the most authoritative volume of its kind in the field of nonmetallics other than fuels, was made possible through the Seeley W. Mudd Memorial Fund of the American Institute of Mining, Metallurgical & Petroleum Engineers. Dr. Joseph L. Gillson, current president of the AIME, was editor-in-chief. Published by the American Institute of Mining, Metallurgical & Petroleum Engineers, 28 W. 39 St., New York 18, N. Y. Pp 934. Price $12.

Sintering Symposium held by the Australian Institute of Mining & Metallurgy, August 1957. Papers included in this report include: a history of sintering developments at Port Pirie; fundamental factors of sintering; heat flow and movement of the combustion zone in a sinter bed; research on the sintering of fine hematite ores; factors controlling lump output from a sintering process; laboratory studies of the updraft lead sintering process; Bunker-Hill presintering process; factors in Imperial Smelting Corp.'s zinc-lead sinter production; sintering practice at Avonmouth Works of Imperial Smelting Corp.; gas recirculation in sintering lead and zinc concentrate by members of the Lurgi staff; materials, methods, men and maintenance in sintering at Broken Hill; problems arising from production requirements by the staff of Mt. Isa; engineering problems in sinter plants —plant design, maintenance, etc., by staff members of Australian Iron & Steel Ltd. Published by the Australian Institute of Mining & Metallurgy, 399 Little Collins St., Melbourne, Australia. Pp 380. Price £1 10s plus postage to members; £2 10s plus postage to non-members.

Iron Ore Beneficiation, by Lawrence A. Roe, manager of process engineering, International Minerals & Chemicals Corp. Chapters in this book cover the following subjects: history, sources and economics, iron ore minerals, washing and jigging, heavy-media separation processes, tailing and spiral treatment, flotation, magnetic separation, pyrometallurgical processes, hydrometallurgy and by-products, agglomeration, and research. References concluding each chapter and at the end of the book indicate the extensive research which the author has performed to compile the volume. The purpose of the book is to bring together the scattered bits of information that exist on the subject, and in this respect the book constitutes an excellent foundation for anyone interested in keeping up with the expanding field of iron ore beneficiation. **(Editor's note:** A review of the book was inadvertently omitted upon receipt of the volume in August 1957. The fundamental coverage of the subject warrants mention at this time.) Published by Minerals Publishing Co., Box 85, Lake Bluff, Ill. Pp 305. Price $5.

Tellurium, by Frank Fisher, commodity specialist, U. S. Bureau of Mines. This preprinted chapter from Bulletin 585 estimates that tellurium reserves in the U. S., based on the association of this element with copper, total 6.5-million lb. Although tellurium is favored for military thermoelectric devices, it is not on the Office of Civilian Defense Mobilization's list of critical and strategic materials. For sale by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Pp 6. Price 10c.

Silicosis and Other Industrial Pulmonary Diseases. The June 1960 issue of INDUSTRIAL MEDICINE & SURGERY features the 1960 McIntyre Research Foundation Conference on Silicosis & Other Pulmonary Diseases. Twelve papers presented at the conference are published. Subjects include dust control and ventilation, trends in silicosis among miners in Ontario, studies of workers who have received the McIntyre aluminum-powder therapy, and several technical papers of specific interest to medical staffs of mining companies. Review copy submitted through courtesy of McIntyre Research Foundation, Suite 1500, 25 King St. W., Toronto 1, Ontario.

Mining Year Book, 1960. This volume, compiled by Walter E. Skinner, contains information on 1,000 world mining companies, production tables of gold and base metals for the past three years, and an international buyers' guide. Obtainable from Walter E. Skinner, 20 Copthall Ave., London, E.C. 2, England. Pp 824. Price $7, including postage and packing.

BOOKS presented on this page may be obtained directly from the publisher mentioned in each case. E&MJ does not sell books.

Geology: Principles and Processes, Fifth Edition, by William H. Emmons, late professor of geology, University of Minnesota; Ira S. Allison, professor of geology, Oregon State College; Clinton R. Stauffer, professor emeritus of geology, University of Minnesota, and research associate, California Institute of Technology; and George A. Thiel, professor of geology, University of Minnesota. This text provides, as did previous editions, a sound basic introduction to geology for the student planning to major in earth sciences. Short sections on climatology, meteorology, soils, oceanography and seismology have been added. Economic aspects of geology are treated in appropriate places in the text instead of in one chapter. The extensive use of color in illustrations adds greater visual clarity to the text. Published by McGraw-Hill Book Co. Inc., 330 W. 42 St., New York 36, N.Y. Pp 491. Price $7.95.

Transformers and Generators for Power Systems, by R. Langlois-Berthelot, professor of electrical engineering at Ecole Superieure d'Electricité, Paris. This book is written for the engineering student who has a thorough knowledge of physics, for the engineer concerned with design and manufacture, and for the operating engineer. Published by the Philosophical Library Inc., 15 E. 40 St., New York, N.Y. Pp 541. Price $12.

Statistical Summary of the Mineral Industry, including world production, exports and imports, 1953-58. Prepared by Mineral Resources Div., Overseas Geological Surveys, and published by Her Majesty's Stationery Office, Atlantic House, Holborn Viaduct, London E.C. 1, England. Pp 389. Price £1, 7s., 6d. net.

Best's Safety Maintenance Directory combined with **Manual of Modern Safety Techniques** is a basic guide to safety and maintenance products, equipment and techniques. The following new sections have been added to the book: waste disposal equipment, in-plant communications equipment, liquefied petroleum gas handling equipment, in-plant hospital equipment and in-plant feeding equipment. Published by Alfred M. Best Co. Inc., 75 Fulton St., New York 38, N. Y. Price $7.50.

Geophysical Survey in Eastern Washington. Director Earl Coe of the Washington Department of Conservation announced the release of five combined aeromagnetic and radiometric maps covering a 935-sq mi area in northwestern Ferry County and northeastern Okanogan County. Basic data in the report includes continuous airborne recordings of the total intensity of the earth's magnetic field and radiometric scintillometer readings. Flying was done by Hunting Geophysical Services Inc., New York City. Results of the survey are described in a 34-page report, "Geological Interpretation of Airborne Magnetometer and Scintillometer Survey, Mt. Bonaparte, Bodie Mountain, Curlew, Aeneas and Republic Quadrangles, Okanagon and Ferry Counties, Washington." Accompanying the report are five sets of maps for each of the quadrangle areas showing aeromagnetic and radiometric data, the same data printed on translucent paper without a base map for use as an overlay, mineral commodity maps showing mines and prospects and location of National Forest and State-owned lands, height of the survey aircraft above ground shown by contours, and geologic interpretations. Reports may be purchased at the Department of Conservation, 335 General Administration Bldg., Olympia, Wash. Price for the maps and report is $1.50.

New Water for a Thirsty World, by Michael Salzman, with foreword by Aldous Huxley. This book carries a vital message for the present and future welfare of the United States. It crosses the fields of science to bring together a complete and documented presentation of the background, theory and practice of scientifically locating economic and noncontaminable supplies of fresh water flowing in solid rock fissures. The jacket of the book carries a map showing where the critical water shortage areas in the U.S. are expected to be in 1970. Lower California and Arizona, and the center of the Ohio Valley, present the darkest pictures. Published by Science Foundation Press, 73314 Ascot Station, Los Angeles 3, Calif. Pp 210. Price $5.95.

BLAST HOLES FOR WORCESTER DIVERSION PROJECT DRILLED WITH BETHLEHEM HOLLOW

This 16-ft-diameter tunnel was driven a total of 4150 ft for the Worcester Diversion Project. This was a flood-control job, constructed recently on the Blackstone River, near Auburn, Mass. The project was under the supervision of the New England U. S. Army Engineers Division, Corps of Engineers. The holes for the blast charges were bored to an average depth of 6 ft, using Bethlehem Hollow Drill Steel. The contractor was Kero-Curly Corp. Bethlehem Hollow Drill Steel is ideal for all types of rock drilling because of its economy and dependability. It is furnished in Carbon and Ultra Alloy grades in rounds, hexagons, and quarter octagons, in lengths from 18 ft to 27 ft.

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
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BETHLEHEM STEEL

WHAT'S NEW IN PATENTS

OLIVER S. NORTH

U. S. PATENTS

Mineral Processing

In the production of high-purity thorium oxide, ore is leached with a mineral acid, and the acid leach solution is subjected to the solvent action of an alkyl phosphate solution containing about 5% dibutyl phosphate or tributyl phosphate. Impurities are removed with hydrochloric acid, and the thorium is stripped with solutions of sulphuric acid and an alkali carbonate. The two thorium-containing solutions are mixed, and the pH is adjusted to precipitate thorium oxalate, which is recovered and calcined. C. C. Christensen and J. D. Prater, assigned to Kennecott Copper Corp. No. 2,945,-742.

Ion exchange process for producing high-purity rhenium-bearing solutions from impure rhenium-bearing solutions derived from the leaching of flue dusts, e. g. dusts derived from the roasting of certain molybdenum sulphide metallurgical concentrates. S. R. Zimmerley and J. D. Prater, assigned to Kennecott Copper Corp. No. 2,945,743.

Method for preparing and roasting iron oxide ores, e. g. hematite or nonmagnetic taconite, to enable concentration of the iron values by magnetic methods. The ore is moistened and rolled; the resulting lumps are laid in a relatively thin layer on a sintering band, and then passed in sequence through a drying zone, a reaction zone where hot reducing gases are passed through the bed, and finally, a cooling zone. N. F. Schulz, assigned to Regents of the University of Minnesota. No. 2,945,755.

Pellets are formed on an endless belt in an economical and continuous process and apparatus for forming into green pellets finely divided oxidic iron ore or concentrates, such as magnetic taconite. A. W. Mathews and J. J. Banke. No. 2,946,086.

Design for a multi-cone apparatus for concentrating mineral values in a completely dry state, in the absence of any chemicals or other extraneous agents. A cyclical mechanical backwashing action is provided, whereby during a series of movements the mineral particles are separated from additional portions of gangue and become increasingly concentrated. F. W. Hack. No. 2,946,442.

Method of controlling the mechanism which loads the stockline of a vertical furnace used for indurating iron ore pellets or the like. The fragile material is laid down in a manner to compensate automatically for irregularities in the stockline profile, and thus to maintain a substantially uniform stockline. F. D. De Vaney and D. Beggs, assigned to Erie Mining Co. No. 2,946,469.

To improve the percentage of iron recovery during subsequent froth flotation, hematite, taconite, Mesabi rejects or other iron oxide ore is ground to flotation size in the presence of small amounts of carboxylic acid, such as crude or distilled tall oil and fuel oil. The ground material is then pulped and subjected to froth flotation. F. H. Bunge and I. G. Pocrnich, assigned to M. A. Hanna Co. No. 2,944,-666.

Design for a sluice box and riffle construction whereby numerous pockets are provided for retaining gold or other heavy metal values. Rapid vibration, of only slight magnitude, causes water flowing over the riffles to swirl and eddy. This apparatus will effectively recover extremely small gold particles. J. Stephan. No. 2,944,668.

In the solution mining of common salt or like water-soluble mineral salts, a cold brine at a temperature below zero deg C is first pumped through, and then an aqueous slurry of ice fragments is sent through to enlarge and extend passageways between wells. A. W. Hanson, assigned to Dow Chemical Co. No. 2,944,-803.

Copies of U.S. patents can be purchased at 25¢ each from Commissioner of Patents, Washington 25, D.C.

Recovery of high-grade nickel carbonyl from roasted or reduced nickel-bearing sulphide ore concentrates containing as impurities cobalt, iron, copper, etc. Roasted concentrate containing optimum proportions of the cited metals is reduced to activate the metals, and then is treated with carbon monoxide, under pressure, to co-extract nickel and cobalt and a controlled amount of the iron. The nickel, cobalt and iron carbonyls are separated and decomposed. P. E. Queneau, S. C. Townshend and R. S. Young, assigned to International Nickel Co. Inc. No. 2,944,883.

In the production of high-iron concentrates, the ore grinding step is facilitated by first converting the iron to non-malleable iron carbide, which may be more readily broken away from the gangue. For example, crushed non-magnetic taconite is mixed with non-coking, highly reactive peat char; and the mixture is heated in a retort at 1600-2000° F while removing gases from the retort. The ore is then rapidly cooled, ground and magnetically separated; and the iron fraction is agglomerated. G. H. Halvorson, assigned to U.S. Steel Corp. No. 2,944,-884.

In the extraction of uranium values from acid-digested phosphate rock, the values are precipitated with a sulphoxylic acid derivative, e. g. sodium formaldehyde sulphoxylate. R. E. Stedman, assigned to Imperial Chemical Industries Ltd. No. 2,945,741.

In the extraction of tungsten values from scheelite or other tungsten ores, a mixture of ground ore and oxalic acid is treated with ammonia. The resulting ammonium paratungstate is recovered and decomposed to tungstic acid. R. C. Osthoff, assigned to General Electric Co. No. 2,942,940.

Method for separating columbium and tantalum, rare earths, and other metals of groups IIIB, IVB and VB of the periodic table. The metals in solution are treated with a complexing agent containing an aluminum cation that complexes the selected metal compound, and separation is then effected by fractional precipitation. K. Peters. No. 2,943,101.

In the chlorination of rutile or ilmenite, the chlorination vapors are cooled so as to retain the titanium tetrachloride in the vapor phase, while precipitating fine ash, coke and ferric chloride in a substantially free-flowing state. The latter solids are removed with an innocuous gas in such a manner as to prevent egress of the titanium tetrachloride vapors. W. H. Coates and J. Hayden, assigned to British Titan Products Co. Ltd. No. 2,943,704.

Design for a wet vibrating table for concentrating mineral values from ores on the basis of specific gravity. Motion imparted to the table causes the ore to move counter to both slope of the tray and direction of movement of the water flow. J. A. Manning. No. 2,943,736.

In the separation of columbium from tantalum by solvent extraction, a hydroxide mixture is prepared by fusing a columbite-tantalite-type ore with sodium hydroxide, treating the fused mass with hydrochloric acid, and separating the hydroxides by centrifugation or filtration. The hydroxides are dissolved in an aqueous glycolic acid solution, and this solution is shaken with an equal volume of furfural. The resulting aqueous phase contains a concentration of columbium, while the furfural phase is enriched in tantalum. L. H. Brown and F. K. Cole, assigned to Quaker Oats Co. No. 2,943,-912.

Improved process for roasting finely divided pyrite, pyrrhotite and other iron sulphide materials at very high throughput rates per unit of hearth area. Ore is subjected to fluid-bed roasting at 1000-1800° F, while passing an oxidizing gas containing free oxygen upward to fluidize the material. Solids are separated from the exhaust gas and returned to the bed in large excess over the amount of fresh ore being introduced. A low-sulphur calcine is obtained. G. H. C. Norman, assigned to International Nickel Co. Inc. No. 2,943,929.

Furnace for reducing metal oxide ores, such as iron oxide or complex metal ox-

Mr. North is patent consultant, Washington, D.C.

Blake Jaw Crusher

For Primary Crushing we can supply Blake Jaw Crushers in all sizes up to 84″×66″ intake.

SKF ball bearings are fitted as standard in the eccentric shafts and frames of all models.

The picture shows a Blake Jaw Crusher No. 19 with an intake opening of 84″×60″.

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Sweden

ide ores, wherein a constant pressure is applied to an incandescent ore-carbon mixture to maintain intimate contact between the particles in the mixture, and to efficiently reduce all of the metallic oxide in the ore. The variables can be adjusted to first smelt out an impurity metal. A. K. Crabill, assigned to E. J. Lavino & Co. No. 2,946,581.

Improved cyclic wet alkali aluminate process, based on the Bayer method, for producing alumina from bauxite or other aluminous materials containing monohydrate alumina. D. J. Donaldson, assigned to Kaiser Aluminum & Chemical Corp. No. 2,946,658.

Ground sylvinite ore is pulped with water, an aliphatic amine, and a silicone fluid modifier such as methyl silicone, phenyl silicone or methyl hydrogen silicone, in the froth flotation concentration of a relatively coarse sylvite fraction. The silicone serves as a collector for coarse sylvite and reduces consumption of the amine. E. A. Schoeld and J. M. Fritschy, assigned to Potash Co. of America. No. 2,934,208.

Amine-treated pulp is further conditioned with an amine-miscible, high-molecular-weight alcohol, in an improved method for the froth flotation of coarse particles of sylvite from sylvinite ore. The pulp is then aerated to float a coarse sylvite product in the absence of a froth bed. E. A. Schoeld, J. M. Fritschy and J. D. Nabors, assigned to Potash Co. of America. No. 2,937,751.

In the recovery of metals from mixed nickel sulphide ores, the ore is subjected to an oxidizing roast at 500-800° C, and the resulting low-sulphur calcine smelted in an electric furnace. The nickel-copper matte is crushed and then leached with aqueous sulphuric acid to solubilize the nickel and leave a residue containing copper, precious metals, etc. J. W. Donaldson and H. F. Davis Jr. assigned to Quebec Metallurgical Industries Ltd. No. 2,934,428.

Fluidized-bed process for producing titanium tetrachloride by the chlorination of pulverized ilmenite or other ores or materials containing titanium oxide. A mixture of ore and carbon is agglomerated to a mesh size of 8-200, and the agglomerates and gaseous chlorine passed through a reaction zone heated at 700-950° C. C. W. Andersen, assigned to Monsanto Chemical Co. No. 2,936,217.

Solution is contacted with a trialkyl phosphine oxide as the extractant, in an improved process for recovering uranium values from aqueous solutions produced by leaching uranium ore with nitric acid, hydrochloric acid, or sulphuric acid. C. A. Blake Jr., K. D. Brown and D. E. Homer, assigned to U.S. Atomic Energy Commission. No. 2,937,-925.

Ore concentrates are treated with superheated water and the resulting 3-phase pulp is centrifuged, in the recovery of elemental sulphur from either high- or low-grade native sulphur ores. P. J. McGauley. No. 2,934,413.

In the separation of columbium and tantalum pentachlorides from one another in anhydrous solutions, the solution is contacted with liquid phosphorus oxychloride, and then fractionally distilled in an inert atmosphere. The columbium and tantalum values are separately condensed. W. Scheller and H. Abegg, assigned to Ciba Ltd. No. 2,936,214.

In a process for flocculating slimes resulting from the grinding of ores, the ore slurry is treated with a water-swellable and dispersible cross-linked collagen-derived organic nitrogenous colloidal substance of the protein class, such as glue or gelatin. M. B. Goren, assigned to Kerr-McGee Oil Industries Inc. No. 2,937,143.

CANADIAN PATENTS

Mineral Processing

Froth flotation process for concentrating pyrochlore from ores containing calcite, apatite and silica as associated gangue minerals. An amine having 14-22 carbon atoms floats the pyrochlore. Suitable amines include those trademarked Duomeen T, Amine 220, Amine 1180 and Rosin Amine D Acetate. H. G. Burks. June 14, 1960. Canadian 599,684.

In the production of electrolytic nickel, a nickel matte anode is processed in three steps: electrolytic production of high-purity nickel; electrolytic neutralization of the anode slimes at increased current density; and removal of iron and copper from the slimes liquid. The refined liquid is recirculated to the first step. T. Horii and K. Maejima. June 14, 1960. Canadian 599,745.

In the froth flotation of columbium-bearing minerals from an alkaline ore, ammonium, potassium or sodium bicarbonate is added to the ore pulp to improve the efficiency of the amine or diamine collector reagents. H. L. Noblitt. June 14, 1960. Canadian 599,760.

Process for indurating pellets of magnetic taconite ore which makes maximum use of heat ordinarily wasted and of the exothermic heat produced by reactions in the ignited bed. Induration is accomplished by down-draft ignition and recuperation and up-draft circulation of the cooling air. A relatively thick bed of pellets is indurated. Pellets are discharged at a temperature low enough to eliminate need for further cooling operations, e. g. spraying with water. Due to the effective utilization of all available heat, the temperature of the furnace room is reduced to a more bearable state. R. J. Linney, assigned to Reserve Mining Co. June 14, 1960. Canadian 600,026.

In the production of zinc metal from metal halogen or oxide contaminated starting materials, such as zinc drosses, zinc residues, zinc skimmings, etc., a mixture of the starting material, lime and coke, is ball milled. The milled mixture is reacted with molten calcium chloride in an argon-purged atmosphere at a temperature of about 975° C. The gases are passed through a condenser where the zinc is recovered. E. Wainer, assigned to Horizons Inc. June 14, 1960. Canadian 600,050.

Design for an oscillating-vibrating multiple-pan apparatus for concentrating heavy mineral (e. g. gold) particles from unconsolidated materials such as sand or gravel, crushed ores, etc. The machine uses little or no water, and hence is particularly useful in areas where the supply of water is limited. A. A. Johnston. June 21, 1960. Canadian 600,-082.

In an improved process for leaching sylvinite ore, whereby the slimes problem is largely overcome, a deep bed of ore particles, sized to the 2-28 mesh size range, is leached with hot sodium-chloride-saturated mother liquor flowing downward through the ore, while the bed is maintained undisturbed. W. P. Wilson, assigned to U.S. Borax & Chemical Corp. June 21, 1960. Canadian 600,-446.

In the elimination of nickel from cobalt-containing sulphate or chloride solutions obtained by treating a cobalt ore with an acid, the solution is simultaneously treated with sodium hydroxide, enough to precipitate the nickel present, and with hydrogen and elemental or sulphide sulphur, at a pressure of 3-50 atmospheres and a temperature of 80-115° C. P. E. Corbiau, assigned to Soc. Gen. Metallurgique de Hoboken. June 21, 1960. Canadian 600,460.

Copies of Canadian patents can be obtained by writing to Commissioner of Patents, Patent & Copyright Office, No. 8 Bldg., Carling Ave., Ottawa.

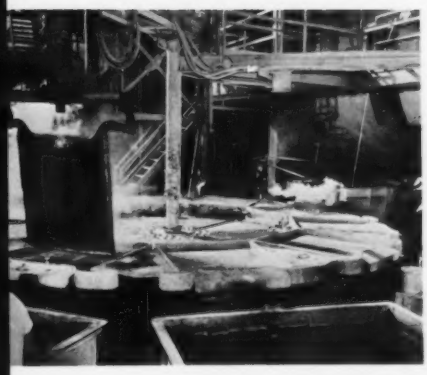
In the production of lithium carbonate from spodumene ore, natural spodumene is heated to convert it to the beta form, then the beta spodumene is pressure-leached in a solution containing sodium and calcium hydroxides. Solids are filtered off, and the solution is treated with carbon dioxide gas to precipitate lithium carbonate and calcium carbonate. The solids are filtered off, and purified to obtain the lithium carbonate. The solution from the gas treatment step is purified of calcium carbonate, and the hydroxide-enriched solution is recycled to the leach step. P. A. Cubb. April 19, 1960. Canadian 596,302.

In a process for recovering chromium from chromite or other ores containing iron and chromium, a mixture of ore, coke or coal, a suitable flux, and sodium chloride or an alkaline-earth-metal chloride, is smelted. Iron-free chromium is recovered from the gases from the smelted charge, while metallic iron is recovered from beneath a low-melting slag in the furnace hearth. The gases are so treated as to recover solid chromium trichloride and to leave the ferric chloride in vapor form. R. A Halversen, assigned to diverse individuals. April 19, 1960. Canadian 596,656.

(*patents continued on p 140*)

from mine and pit to mill and smelter...

WESTINGHOUSE PROGRESSIVE AUTOMATION CAN HELP YOU STEP UP TONNAGE WHILE CUTTING COSTS



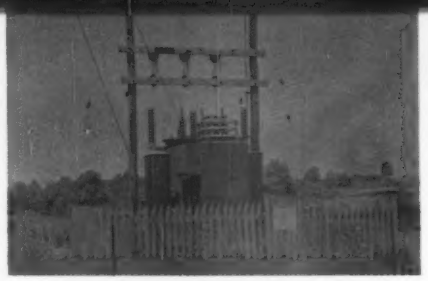
A highly reliable and efficient electrical system must hold a top priority in your equipment planning. You can achieve such a system through Westinghouse *Progressive Automation.*

Progressive Automation is a Westinghouse concept to help you plan economical steps to automatic production. Westinghouse engineering facilities are available, for example, to help plan a substation, lay out a plant distribution system, or develop a computer program. Any such planning should be twofold: to meet present needs and to foresee future expansion and growth.

Look over the following pages for some of the Westinghouse equipment now contributing to more automatic, less costly and more efficient production.

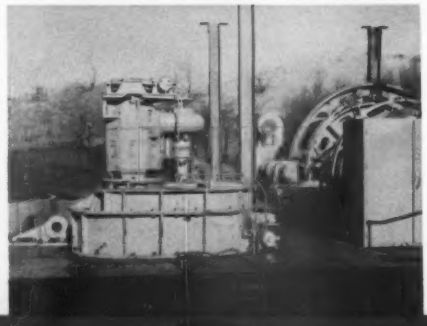
Westinghouse

Power distribution starts with dependable Westinghouse UNIT SUBSTATIONS, which are shipped completely assembled and pretested. Their compactness makes them ideal for mining operations because they can be moved as mining progresses.



Portable Westinghouse SWITCH HOUSES, to control and protect the high-voltage circuits to portable mining equipment, provide safety and continuity of service features. Reliably designed safety circuits guard personnel against hazardous conditions.

The trend of the industry in removing overburden is toward excavating equipment of greater capacity. Faster work cycles at heavier duty place unusual demands on motors and control. Westinghouse SHOVEL MOTORS and M-G SETS have the stamina to give years of highly productive service . . . to help you get maximum tonnage out of every shift. In addition, Westinghouse supplies all-static-control assemblies, marking a new era of dependability in shovel performance.



open pit mining

underground mining

crushing

Westinghouse sealed mine POWER CENTERS safely and reliably step down incoming power to utilization voltage levels. Nitrogen-filled, silicone-insulated power centers are completely protected from contaminating atmospheres.

Movement of material from deep-mines and open pits to the surface emphasizes the critical role of the modern mine hoist. Efficient power distribution systems and dependable HOIST MOTORS and STATIC CONTROL contribute to lower cost hoisting.

Westinghouse LIFE-LINE® "A" INDUCTION MOTORS drive slusher hoists. In addition, Westinghouse supplies d-c motor-generator sets, motors and controls for slushers.

In crusher applications, Westinghouse wound rotor MOTORS provide the high breakaway torque required to handle a large process mass, particularly in cold weather—and with less current inrush than squirrel-cage motors. The F/A MOTOR (foreground) with exclusive Thermalastic® insulation is fully accessible and makes for faster, easier inspection.

one source, one responsibility...

A WESTINGHOUSE COORDINATED ELECTRICAL SYSTEM IS TAILORED TO YOUR PROCESS EVERY STEP OF THE WAY

The mining operations and Westinghouse power distribution and utilization equipment (illustrated) are typical of the industry. Safety, reliability and continuity of mining operation have been paramount considerations in the design of these system components. Complementing this apparatus, Westinghouse data logging, programming and computer equipment can help even further to make plants more efficient.

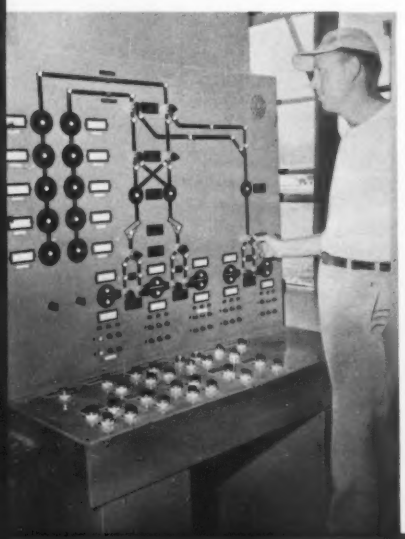
Your program for automation actually starts with the drive, control and power distribution components of your present system. Then you add new Westinghouse equipment, taking advantage of the latest product developments and control techniques. The next step is with Westinghouse coordinating control systems, utilizing data logging and other devices. Each stage of automation has been preplanned to meet immediate and future objectives . . . to increase total production, introduce quality improvement measures, or control high-cost areas of production.

WESTINGHOUSE PROGRESSIVE AUTOMATION... A LOGICAL PLAN FOR INCREASING PRODUCTION

Through years of experience developed through close association with your industry, Westinghouse has helped solve the problems of mining and processing huge quantities of ore . . . economically. Westinghouse is prepared to undertake analysis and study leading to the recommending, furnishing, installing and maintaining of equipment. For more information on *Progressive Automation*, call your Westinghouse representative. You can be sure . . . if it's Westinghouse.

Westinghouse

AUTOMATIC CENTRALIZED CONTROL permits an operator to follow flow of ore from one processing step to another through indicator lights. This sequence control affords an interlocking system for a group of conveyors. Such control reduces chance of human error, increases output, and improves product quality with substantial savings.

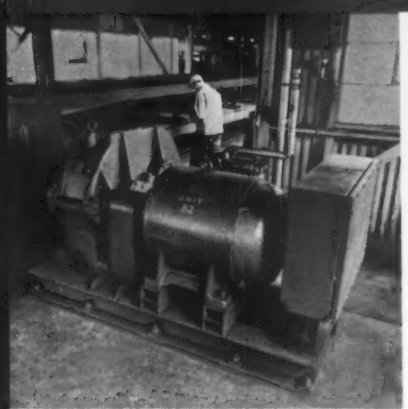


Classifier drive and flotation cell drive requirements vary with process
require the use of squirrel-cage motors. The Westinghouse SQUIRREL-C
of strong, trouble-free construction. New Guardistor* motors provide
based on winding temperature . . . let you match the full capability of moto
of enclosed motors meets severe conditions encountered in abrasive atmos
*Trade-Mark

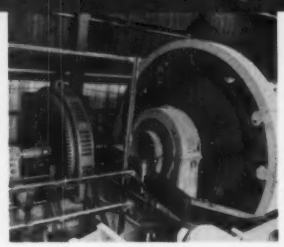
conveyors

grinding

concentrating



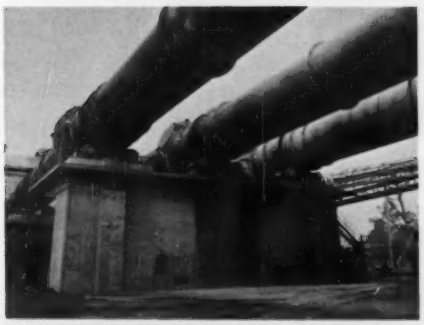
Westinghouse has wide experience in designing drives for conveyor systems for maintaining continuous flow. One of the newest is the MAGNAFLOW* electromagnetic drive suitable where soft starts or adjustable speed is desired. Westinghouse motor, speed reducer and control give dependable, trouble-free performance. *Trade-Mark



Ball mill drives must be engineered to provide the critical starting torque, without upsetting the stability of the power system. Westinghouse SYNCHRONOUS MOTORS with the new STATIC SLIPSYN® CONTROL provide a drive with maximum reliability, minimum maintenance.

Westinghouse LOAD-O-MATI
TROLS use saturable reactor-cont
induction motors to provide the
required for fine crane control, es
and close bucket drives. Specific b
heavy-duty design for reliability, st
static components; front wired, fro
*Trade-Mark

The Westinghouse AV DRIVE, employing an all-static magnetic amplifier regulating system, provides the most advanced drive for casting wheel drives to insure smooth-surfaced anodes. Two principal advantages are automatic stepless acceleration and deceleration, and accurate wheel positioning. Latest design Type AVR (Reactifier) DRIVE gives wide speed range and stepless speed control . . . uses power Magamps for efficient, static power conversion.



Modern kiln operations have forced the replacement of wound rotor motors with more efficient adjustable speed drives. Westinghouse offers a complete selection of these drives. One drive with unique characteristics is RECTI-FLOW*. It has low inrush currents on startings and is available either as a constant horsepower or constant torque device with up to 3:1 speed range and low speed efficiencies of about 75%.

*Trade-Mark

Westinghouse FURNACE TRANSFORMERS competently handle exacting and varied current and voltage requirements. These units bring power to melting processes more economically and use it more efficiently for a net increase in production and reduction in power costs.

ocess flow but normally
REL-CAGE MOTOR is
vide positive protection
motor to the job. Design
atmospheres.

ing

smelting and refining

product

IATIC* CRANE CON-
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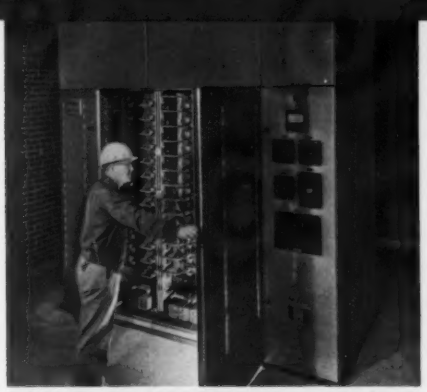


To supply large blocks of direct current to electrolytic refining cells efficiently, the Westinghouse silicon rectifier is the ideal answer—at any voltage. Power savings on an installation are substantial. Recently, Westinghouse installed the world's largest SILICON RECTIFIER unit, rated 10,000 amps, 600 volts d-c, for a large metals producer.

Westinghouse silicone-insulated MC MILL MOTORS are engineered to meet demands of rough duty such as tipping electric furnaces used to convert metals. Improved field coil design provides greater capacity and longer life, while shaft and bearing design withstands heavy shock loads. SA BRAKES, applied on the extension of motor shaft, give accurate positioning.

Westinghouse

PRODUCTION RELIABILITY ASSURED WITH WESTINGHOUSE MAINTENANCE SERVICE

To help keep your plant operating at a profit, Westinghouse offers "Modern Maintenance." This is not a substitute for your own preventive maintenance program, but is designed to supplement it. By coordinating our program with yours, you can be assured of securing the lowest cost and most effective maintenance.

Modern Maintenance includes inspection, testing, modernization, field service, shop repair, and renewal part recommendations backed by highly trained specialists, up-to-date facilities and all the benefits of Westinghouse research and development.

Our maintenance specialists are men who know about the maintenance of electrical, electronic or steam equipment. When they repair a machine, they check it thoroughly—both electrically and mechanically so that your equipment is not only repaired, but modernized. For example, when these men rewind motors, they can use revolutionary insulation processes such as Super COILIFE* or Thermalastic that give motors extra life.

Fast repair service is available from our 42 Repair Plants that are equipped with the latest facilities and processes, with skilled craftsmen to rebuild and modernize your equipment. Fast shipment of renewal parts is assured from our 46 warehouses strategically located in industry centers. You can be sure . . . if it's Westinghouse.

Westinghouse

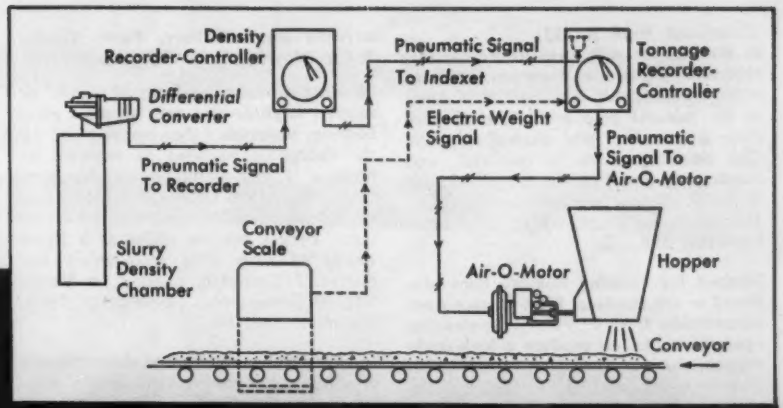
*Trade-Marks

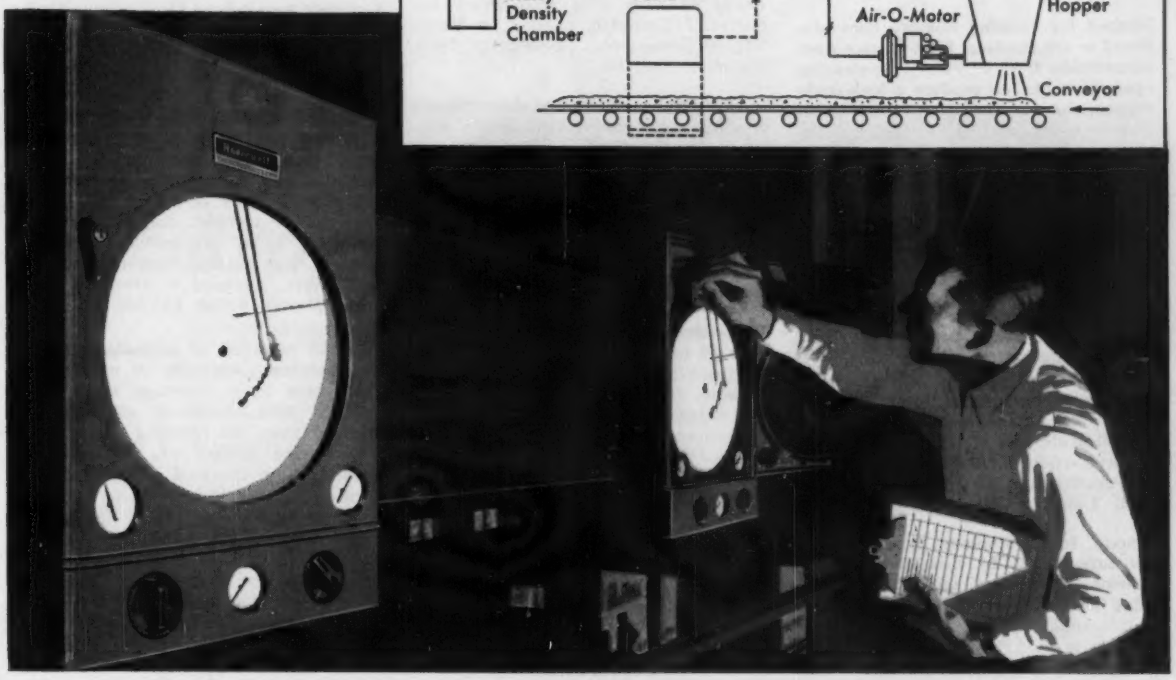
JI-96153

Polyester glass banding is applied to armatures and wound rotors of various ratings with a special Westinghouse-developed tension device, insuring a strength factor equal to steel.

Fast, one-day delivery for renewal parts is guaranteed when you order from your local Westinghouse warehouse.

Metallurgist at American Smelting and Refining Co. adjusts recorder-controllers that automatically maintain constant density of copper slurry by varying tonnage fed to ball mill.





Copper slurry density held within ± 0.2% with Honeywell controls

American Smelting and Refining Co., Silver Bell, Arizona, gets excellent classification of copper slurry . . . holds tonnage and copper recovery high by keeping slurry density constant with a Honeywell control system.

Copper-containing ore is mixed with water in a ball mill, and the overflow is pumped to a cyclone classifier. Overflow from the classifier is fed to the flotation section, where the copper is floated off. Between the classifier and flotation section, slurry density is measured by a displacement unit. A *Differential Converter* transmits the density signal pneumatically to a recorder-controller. This instrument, in turn, transmits a pneumatic signal to the *Indexet* unit which automatically positions the set point index of a tonnage recorder-controller. The tonnage controller is actuated by a conveyor scale on the ore conveyor, and operates a pneumatic *Air-O-Motor* actuator on the gate of the hopper feeding the conveyor. While the tonnage controller responds primarily to weight on the conveyor, it is influenced, through the density controller and *Indexet* unit, to add more ore from the hopper when slurry density is not high enough.

Your nearby Honeywell field engineer can help you profitably apply these controls and Honeywell instrumentation for many other metal production processes. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

75th YEAR PIONEERING THE FUTURE

Honeywell

First in Control

SINCE 1885

(Continued from p 132)

In flotation of such ores as iron oxide, chromite, phosphate, fluorspar, etc., an improved foam is obtained by adding to the mineral pulp a mixture of pure oleic acid and a fatty alcohol sulphate. The resulting foam is not stiff, and coarse gangue particles do not get trapped in it. H. Mottig, assigned to Klockner-Humboldt-Deutz AG. May 17, 1960. Canadian 598,232.

Method for cleaning iron-ore fines produced in ore crushing, blast-furnace dust, concentrates from secondary ore-cleaning operations, etc., to produce a high-grade material for use in making ferrous coke. The fines are roasted, without circulation of air, under the sensible heat of incandescent coke, whereby the material is decarbonated and largely reduced; and then they are washed with water. C. Jully, assigned to Houilleres du Bassin de Lorraine. May 17, 1960. Canadian 598,263.

An improved promoter reagent, for use in cold-water froth flotation of oxide ores of tungsten or iron, consists of a major portion of tall oil acids—optionally containing rosin acids—and a minor portion of a condensation product of tall oil acids with at least four mols of ethylene oxide. S. A. Falconer, assigned to American Cyanamid Co. May 17, 1960. Canadian 598,311.

Process for continuous production of low-carbon iron, by thermal reduction, without smelting, of agglomerated iron oxide with solid carbonaceous material. A substantially pure iron oxide ore concentrate is used, so the sponge product will be relatively pure. A mixture of ore pellets, coke and lime is fired in a rotary furnace; and sponge pellets are recovered from the excess coke and ashes. O. Moklebust, assigned to Titan Co. Inc. May 24, 1960. Canadian 598,458.

In indurating iron-ore briquettes, pellets, etc., a chunk breaker, installed in the furnace in the path of the descending charge, is used to break or crush pellet agglomerations of excessive size. The lower inner walls of the furnace have an inward taper, to direct the charge through the breaker, yet relieve the breaker of an appreciable part of the weight of the overlying charge. A. W. Storm and K. R. Groll, assigned to Erie Mining Co. May 24, 1960. Canadian 598,604.

In recovering alumina and metal values from such materials as "red mud," bauxite, the residue from the manufacture of ferrotitanium, etc., the material is mixed with anhydrous sodium carbonate and sodium borate. The mixture is sintered, and the sinter is washed with boiling water, whereby a carbonate-alumina solution and an iron-enriched residue are obtained. Aluminum is precipitated from the solution with carbon dioxide, and the by-product sodium carbonate is recycled. The iron oxide residue may be smelted for its iron content. F. Gregoire and R. Ricard, assigned to Soc. des Blancs de Zinc de la Méditerranée Eug. Chabury, Pierre Gindre & Cie. May 24, 1960. Canadian 598,678.

In blast furnace smelting of oxide or roasted sulphide zinc ores or other zinc-bearing materials, the composition of the charge is adjusted as required to produce a high-melting-point slag consisting of 45-62% iron oxide, 10-16% calcium oxide, 15-22% silica and 3-7% alumina. Pyrites may be added as a cheap source of iron. Zinc recovery is improved. J. Lumsden, assigned to Metallurgical Development Co. May 24, 1960. Canadian 598,730.

In blast furnace smelting of zinc oxide ore or other oxidic zinc materials, the composition of the charge is adjusted by adding enough bauxite to produce a high-alumina, high-melting slag. Recovery of zinc is improved, and coke requirements are lessened. J. Lumsden and P. A. T. Keeping, assigned to Metallurgical Development Co. May 24, 1960. Canadian 598,769.

To produce oxychloride-free pentachlorides of tantalum and columbium from ores such as pyrochlore, columbite and tantalite, aluminum powder and carbon are mixed with dry ore concentrates. The mixture is sintered, and the resulting porous sinter is chlorinated. C. A. Sutherland, assigned to Nova Beaucage Mines Ltd. May 31, 1960. Canadian 599,161.

BRITISH PATENTS

Exploration

Design for an instrument to be lowered into a borehole, to measure the angle and the azimuth of dip of the geological strata that the hole penetrates. Electrodes are used to obtain electrical logs along at least three profiles of the borehole. F. H. Mann, assigned to British Petroleum Co. Ltd. May 4, 1960. British 833,990.

Mining

Design for a mine-shaft skip having at least three floors for passengers and supplies, whereby handling of men and material is facilitated by using two-level landings. H. Beckmann, assigned to Skip Compagnie GmbH. May 11, 1960. British 834,429.

Metal and Mineral Processing

In separating columbium and tantalum, a mixture of their pentachlorides is contacted with phosphorus oxychloride under anhydrous conditions, and the resulting mixture is subjected to fractional distillation, to obtain a good separation of columbium from tantalum. Assigned to Ciba Ltd. April 27, 1960. British 833,569.

In a two-stage roasting-cyaniding process for recovering gold from gold ores, concentrates or residues containing iron and other metallic elements, the ore is roasted at 1650-2400° F, cooled and optionally pelletized, and treated with an aqueous solution of sodium cyanide and lime to extract the major portion of the gold. The cyanide residue is heated to 1650-2200° F, cooled, and again treated with an aqueous solution of sodium cyanide and lime to extract additional amounts of gold. Assigned to Lakefield Research of Canada Ltd. April 27, 1960. British 833,718-9.

In separating columbium and tantalum occurring in oxide ores, the ore is mixed with ammonium bifluoride, potassium bifluoride, or the like, and heated to a temperature above the melting point of the bifluoride, whereby the columbium is converted to a readily water-soluble complex fluoride, and the tantalum to a less-soluble complex fluoride. The mixture is then extracted with water. Assigned to Horizons Inc. May 4, 1960. British 833,840.

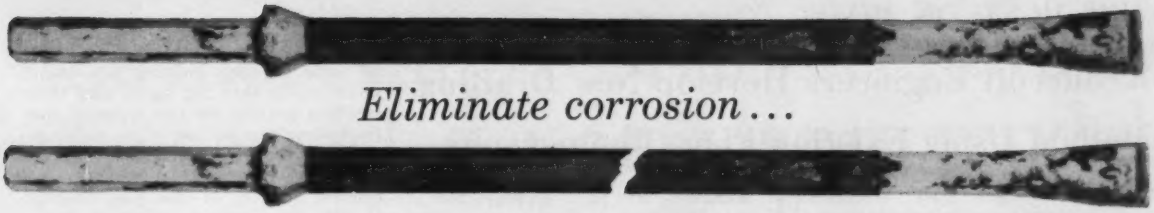
In direct reduction of preheated pulverized hematite, magnetite or other iron oxide ores in a two-stage system of fluidized beds, increased efficiency is obtained from the reducing gas by decreasing the content of the reducing constituents in the final off-gas. Off-gas from the second bed is employed as a reductant in the first. T. F. Reed, assigned to U.S. Steel Corp. May 4, 1960. British 834,042.

In a process for producing from iron-oxide ore a reduced nodulized metal product in a rotary furnace, a damp ore-flux-fuel mixture is passed through a drying zone, a preheating zone, a reduction zone in which sponge is produced, and a nodulizing zone. Marked fuel economies are realized. F. Johannsen. May 4, 1960. British 834,169.

Copies of British patents can be obtained from the Patent Office, 25 Southampton Bldgs., London W.C. 2, England.

Arsenic and sulphur are removed in treating complex ores, e.g. ores of cobalt and nickel that contain sulphur and/or arsenic, by treating the ore or concentrates with a solution of sodium hydroxide or other alkali metal hydroxide; aerating with air or oxygen at elevated temperature and pressure, to produce sodium arsenate and sodium sulphate; and adding lime, to precipitate the arsenate and sulphate as calcium salts. Assigned to Metallurgical Resources Inc. May 4, 1960. British 834,253.

In separating hafnium and zirconium, a mixture of their chlorides is dissolved in a concentrated aqueous solution of ammonium thiocyanate, and the solution is subjected to a partitioning process, using an organic solvent. Assigned to Deutsche Gold- und Silber-Scheideanstalt vormals Roessler. May 4, 1960. British 834,271.



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  Sandvik Coromant Integral Steels are available from 1" to 1¾" bit diameter, in ¾", ⅞", and 1" hexagonal steel section.

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Appearance of a fatigue breakage that often arises with rods that have not been protected against corrosion. Sandvik's SR-treatment* protects against such failures.

*pat. pend.

PROGRESS THROUGH BETTER TECHNOLOGY

BLUE RIBBON MINING AWARD 1960

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Kennecott Engineers Develop New Drafting Method Using Existing Plant Photography

KENNECOTT COPPER CORP. ENGINEERS have developed a new way to use photography in an existing plant for making low cost installation drawings to replace the usual detailed engineering drawing.

Called photodrafting, the technique employs one or more planned photographic positives on which all pertinent facts, figures or line layouts are drawn. Photographs are taken so that the pictures can be arranged in logical sequence on the final "drawing sheets." And a few extra shots are taken to ensure complete coverage.

To date, two products covering the engineering of vacuum cleaning systems for crushing plants have tried photodrafting successfully. The plants are the KCC Chino Mill at Hurley, N.M., which was faced with the problem of updating drawings 35 yrs old, and the mill at Magna, Utah, which provided the medium for working out most of the bugs in the method.

Most significant advantage of the system, according to Kennecott Western Mining Divs.' Engineering Dept., is the savings in time and cost. In both projects an average of 24 engineering man-hours per drawing were used, including time spent on the job taking photographs.

On the Chino job, five photodrawings and one isometric tracing were produced from 56 of the 60 pictures taken. On the Utah project six photodrawings, one isometric and one electrical tracing were produced using 56 of the 61 shots. Cost is about 45% of conventional drawing costs when "as built" drawings are on hand, or about 30% when no "as built" drawings of existing plants are available.

Kennecott says these drawings permit rapid indentification of job requirements, especially when workmen find it difficult to read conventional drawings. Errors are minimized when they are caused by verbose instructions becoming confused or forgotten. Another advantage, say the developers, is from field crews not having to question their supervisors on details of construction.

California Mine Operators Vote to Form Association

REPRESENTATIVES of California mining companies have voted to support the formation of an association of California mine operators.

Founders of the new association stated that it will work to foster better understanding of the mining industry's role in the economic development of the state. This it will do through providing information about the industry for the use of governmental agencies and the general public.

It was emphasized that special efforts would be made to insure that legislation and regulations that affect the mining industry and the availability of mineral resources are keyed to the long-range interests of the state's citizens.

The California State Division of Mines reports that the mineral commodities produced by companies eligible for membership in the proposed association totaled more than $420-million in 1959. But industry spokesmen point out that the overall value of these mineral products is much greater than that figure since these products provide the raw material base for a very large portion of the state's entire manufacturing production.

Present at the meeting were: G. W. Nillson, attorney at law, Los Angeles; C. W. Six, assistant treasurer, Cyrus Mines; J. Lucas, mine superintendent, and P. W. Harrigan, director of public relations, Permanente Cement Co.; R. L. Lambert, controller, and R. H. Whitman, director of exploration and of mining engineering, Riverside Cement Co.; S. L. Yount, properties manager, Consolidated Rock Products Co.; D. L. Marlett, vice president, and R. S. Funk, assistant to the vice president, Great Lakes Carbon Corp.; O. G. Hesselgren Jr., land adminstrator, American Potash & Chemical Corp.; Henry Mulryan, president, Sierra Talc Co.; G. H. Schroter, president Schroter & Lockwood Inc.; J. M. Robinson, vice president, Macco Corp.; I. C. Bechtold, consultant, La Habra, Calif.; Edward Arthur, consultant, Los Angeles; R. F. Brooks, director of mining, Gladding McBean Co.

Brooks was elected temporary chairman of the Southern California chapter; Funk was named temporary secretary, and Lambert temporary treasurer.

TG Potash (*Continued from p 23*)

a 4,000-tpd, 8,000-tpd or 12,000-tpd plant. The firm has engaged the Colorado School of Mines to complete beneficiation studies.

As a result of successful coring of six wells, using air as circulating media, mine engineering is well along to test deposit structure.

Texas Gulf will decide soon whether to locate a 3,000-ft, concrete-lined, circular main production shaft in the gorge of the Colorado river 18 miles southwest of Moab or upon Bartlett Mesa above the Colorado. Hoisting speed and cost will determine if the shaft headframe goes alongside the river or on the Mesa requiring an additional 1,400 ft of shaft.

The vice-president revealed that location of the deposit is under and on both sides of the Colorado River so that they will mine at a 3,000-ft depth beneath the river should Texas Gulf decide to exercise its acquisition rights. This decision will come prior to Jan. 1, 1961.

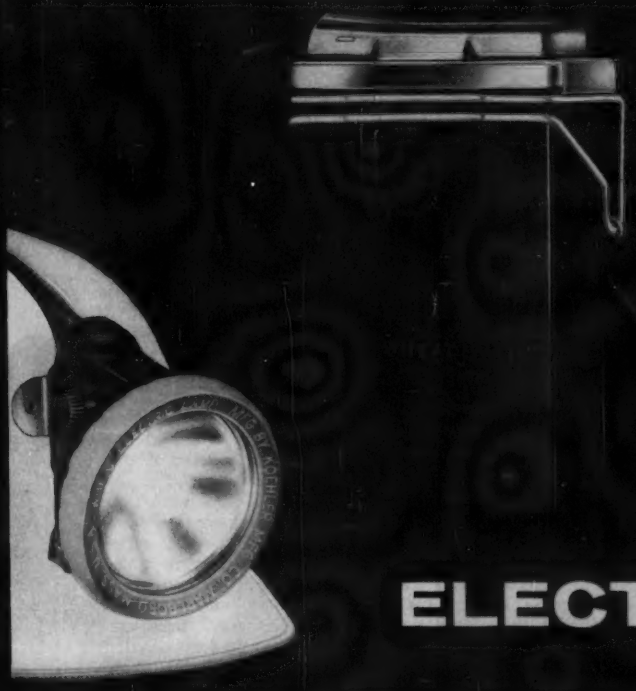
If the oil and gas problems are resolved the board of directors will get positive recommendations to acquire the potash reserves at Cane Creek and at Seven Mile Anticline, nine miles northwest of Moab, from Delhi-Taylor Oil Corp., which originally discovered the mineral. (E&MJ, January 1960, p138; May, p23.)

Fogarty also confirmed that Texas Gulf had obtained freight rate equalization, based on the Carlsbad rate, into the southeastern and midwestern states. Right-of-way applications for construction of a 50-mile railroad from Crescent Junction, on the main line of the Denver & Rio Grande Western, to Bartlett Mesa are in preparation.

THE LARGEST ORE VESSEL ever built for the Great Lakes, Inland Steel's *Edward L. Ryerson*, squeezed through the Soo Line railroad bridge near its fitting-out berth at Manitowoc, Wis., on the way to Lake Michigan for sea trials. This part of the trip required a 90° turn with no room for mistakes.

IN LESS THAN TWO YEARS SINCE ITS INTRODUCTION

–the most impressive acceptance ever accorded a new lamp model by the mining industry!



WHEAT National MODEL ELECTRIC CAP LAMP

–and here are the bedrock reasons why:

A PERFECT SPOT EVERY TIME
Never before has it been so easy for the miner to get the spot he wants. A turn of the switch knob and there it is —and right, every time! A perfect, brilliant spot is equally obtainable *with either of the two full-power identical filaments.*

30% MORE LIGHT
Brighter light than ever, at no increase in battery size or weight! The greater light output of the Wheat National is maintained at high levels during and beyond the entire working shift as photometer tests prove.

TRUE AUTOMATIC CHARGING
. . and the *only* true automatic! With the WHEAT systems, lamps are charged in self-service racks uniformly and automatically regardless of their individual degree of charge or discharge, number of lamps or length of work day or week. Each lamp takes only the current needed to keep it charged, each lamp can be left in the rack for days and cannot overcharge. Every miner gets a fully-charged lamp without manual attention.

SIMPLEST MAINTENANCE FOR LOWEST COST
Ordinary cleanliness, weekly watering and occasional bulb replacement are the simple maintenance requirements of the Wheat National. There are no covers to open, no terminals to clean, no valves to free, no cells to re-solution, no lamps to rack. Wheats need a minimum of manual attention.

Write for WHEAT Electric Cap Lamp Bulletin No. 593—free on request.

National Mine Service Company

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THE APRIL meeting of the Colorado Mining Assn. in Denver included talks by M. P. Romney, Clark Wilson and Ed Snyder.

KAFFEE UND KLATSCH took up some of the time of members' ladies at the three-day session, held in Denver's new Hilton

CMA Speakers Examine Energy Gap, Fluorspar

AMONG the subjects covered in the program of the Colorado Mining Assn. meeting in Denver in April (E&MJ, May 1960, p22) were talks by Donald B. Saxby, chief geologist, Minerva Co.'s fluorspar division, on "Fluorspar 1959," and H. C. Anderson of General Electric Co. and Dr. Laughlin M. Currie, of Babcock & Wilcox, speaking on the uranium picture today.

In his talk, Saxby noted that the U.S. has "always had, and still has the largest proven fluorspar reserves in the world" (see charts), and he observed that reserves have grown steadily as new techniques permit extraction of lower grades of product. "Ore as low as 20% CaF_2 was mined and milled at a profit up to the end of 1958" and the end of the Government stockpile program, he noted.

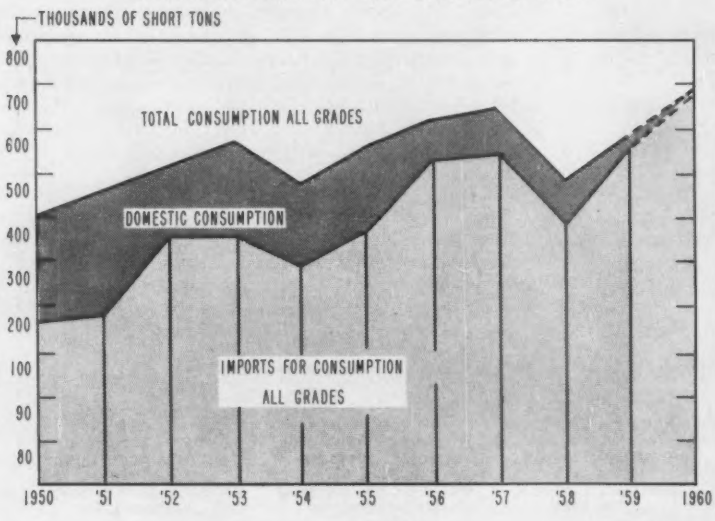
But despite high reserves, and great potential, the speaker said, foreign spar working in the profitable areas of cheap labor, higher grades and low ocean freight vs high railroad freight continues to dominate the market. "Imports for consumption have increased . . . from about 165,000 tpy in 1949 to 550,000 tpy in 1959. . . total consumption in 1959 was 589,000 tons.

The industry has been refused help from the Tariff Commission, and now looks to a future increased European demand for spar as the only possible drain of what it considers excessive foreign shipments of fluorspar to the U.S.

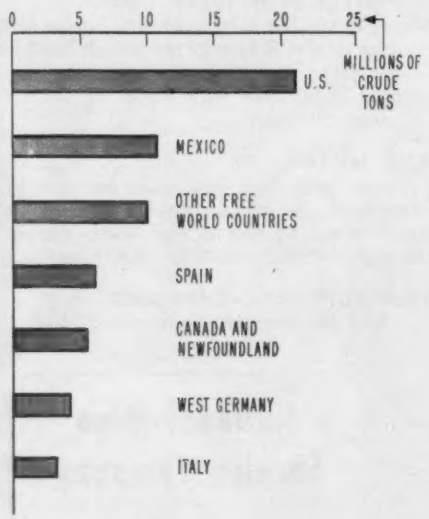
The year 1960 might be termed the one in which "nuclear power started to become competitive," according to H. C. Anderson, Atomic Power Equipment Dept., General Electric Co., San Jose, Calif. Tracing progress in atomic power to date, Anderson said that in early 1956 there were only 10 nuclear projects with ratings of 5,000 kw and over, in various stages of planning, design and construction. This year, there are 31—six operating, nine under contruction, five in design and 11 in the planning stage. Principal reason for the improvement of atomic power in its competitive position with conventional

(Continued on p 146)

FLUORSPAR CONSUMPTION FROM DOMESTIC AND IMPORTED



WORLD FLUORSPAR ORE RESERVES 1959



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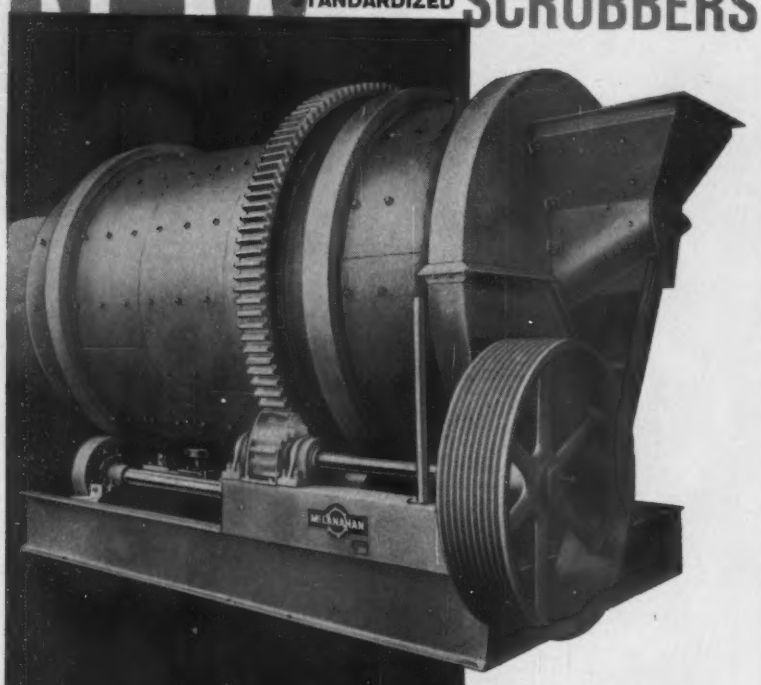

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Energy Gap *(Continued)*

power, has been cutting of capital plant costs by General Electric Co. and others engaged in the design of nuclear facilities. Facts substantiating this progress were reported by Anderson as follows:

A conventional power plant of 100,000-kw capacity, costing $15-million, is said to have a capital cost of $150 per kw. In 1956, something over $400 per kw was considered to be a good average figure for a nuclear plant. Three years later, $325 was about right. Now a plant can be built for slightly over $250 per kw. It took three years for the first $100 reduction, and only one year for the $75 reduction. At the same time inflation is increasing the capital costs of conventional power plants.

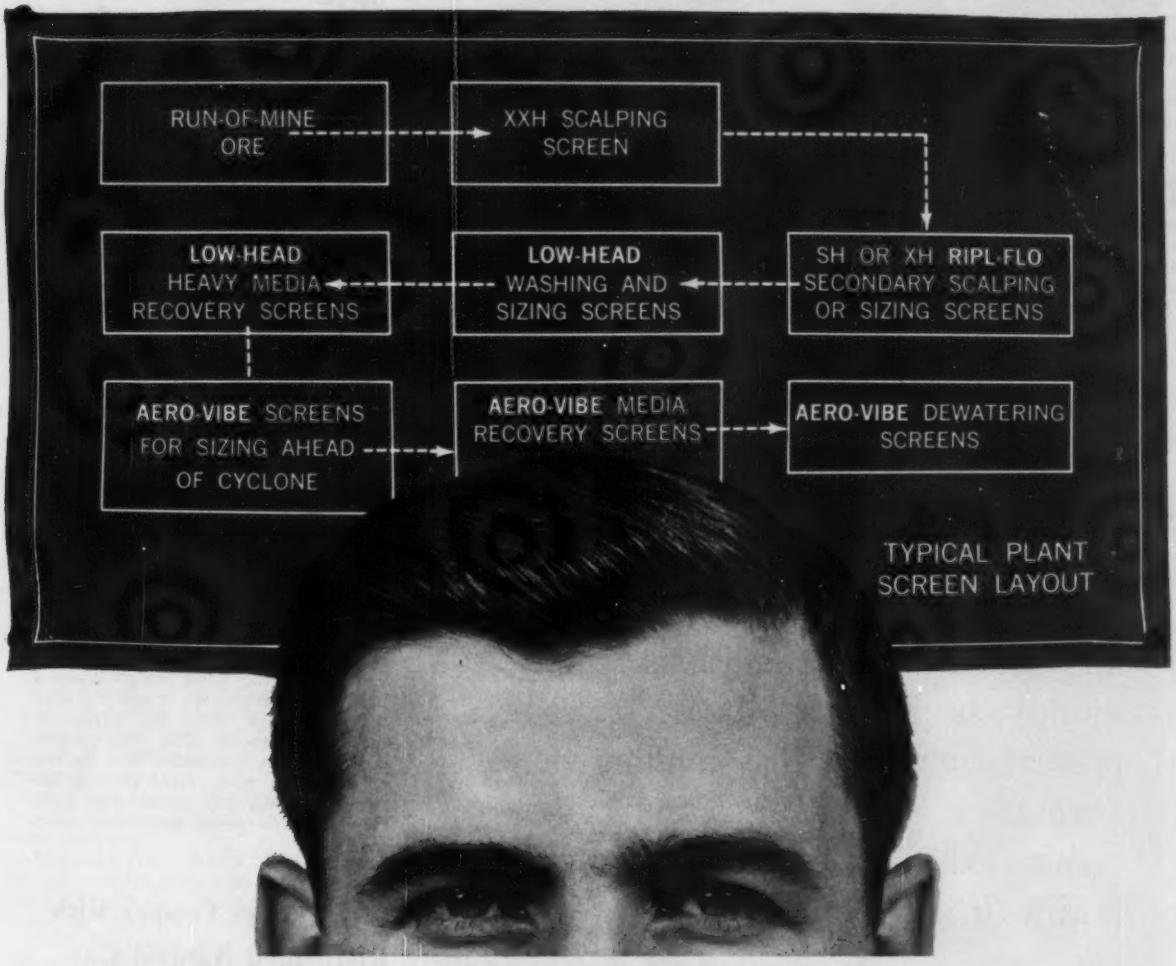
Fuel is the remaining energy cost item. In 1956, 4.5 mills per kwh was a good cost estimate for fuel in an atomic plant. In 1959, it was 3.5 mills, and today it appears to be about 3.0 mills per kwh. During the 1956-60 period the fuel cost for conventional plants in high-cost areas such as New England has risen because of inflation. In such areas nuclear fuel costs are lower than fuel costs for conventional plants.

Nuclear power at about 13 mills per kwh in early 1956 was not competitive with new steam generating capacity. By early 1959, the combined reductions in capital cost and fuel cost has reduced nuclear power cost to about 10 mills per kwh. Today, nuclear power at about 8 mills per kwh is on the threshold of competing for a portion of the power plant market. Hence, this year a utility in the U.S. will purchase a plant based on economics alone. This is the largest reactor ever built for electric power generation — the Dresden Station plant, built by GE for Commonwealth Edison Co. of Chicago. Bechtel Corp. of San Francisco was subcontractor to GE in the construction and design of the plant. Approximately 180,000 tons of uranium ore were required to yield the uranium to start the fuel cycle in the Dresden plant. To keep it running a 70% load factor will require about 36,000 tpy of uranium ore, assuming a recovery of 0.2% U_3O_8 from the ore.

The outlook for uranium in the power industry was projected as follows by Anderson: From an operating capacity of about 1.3-million kw in 1963 total nuclear capacity will grow to 40- to 80-million kw by 1980. On the basis that the average enrichment of fuel for the reactors is 0.2%, and that average recovery from ore is 0.2%, it takes roughly one ton of ore per kw to start a reactor, and about 0.2 tpy of ore to keep it running at 70% load factor. Thus future ore requirements for U.S. nuclear power plants alone will increase from about 1-million tons for 1963 to about 14- to 28-million in 1980. Present production is about 7-million tpy.

Dr. L. M. Currie, vice president of Babcock & Wilcox Co., expressed an optimistic view for the eventual strength of the uranium industry, though his predictions for the near future were conservative.

ALLIS-CHALMERS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All of your screening operations — scalping, sizing, washing, dewatering, media recovery — carry full responsibility for continuous, uninterrupted flow. To live up to this responsibility, your system needs screens that are engineered to do each specific job. A-C engineering has done just that — with a complete line of screens that assure you top performance under the most rugged conditions.

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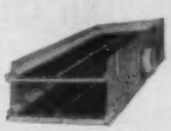
For scalping and coarse sizing, wet or dry — XH **Ripl-Flo** rugged cost saving inclined screen.



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Energy Gap *(Continued)*

"There are more prophets than there are profits in the nuclear business today," Dr. Currie said emphasizing his reluctance to predict the industry's future. Nevertheless, after discussing the outlook for conventional fuels, he said, "Gentlemen, competitive nuclear power is coming," and, having reviewed the progress up to now in nuclear power, he said that the next five years should tell the story of the future.

The "energy gap" was the subject of Dr. Currie's first remarks. To illustrate the urgency of an energy supply to a nation's economy, he cited Britain's participation in the 1956 Suez affair, when Britain mortally feared having her supplies of Middle Eastern oil cut off. Though an energy gap for the U.S. was not likely in the near future, he said, one for Europe could, and likely would, develop; and many countries, for example India, use so little energy that India would need to add a net generating capacity equal to the USSR's, France's, and West and East Germany's combined, just to bring her per capita consumption up to the level of Japan's.

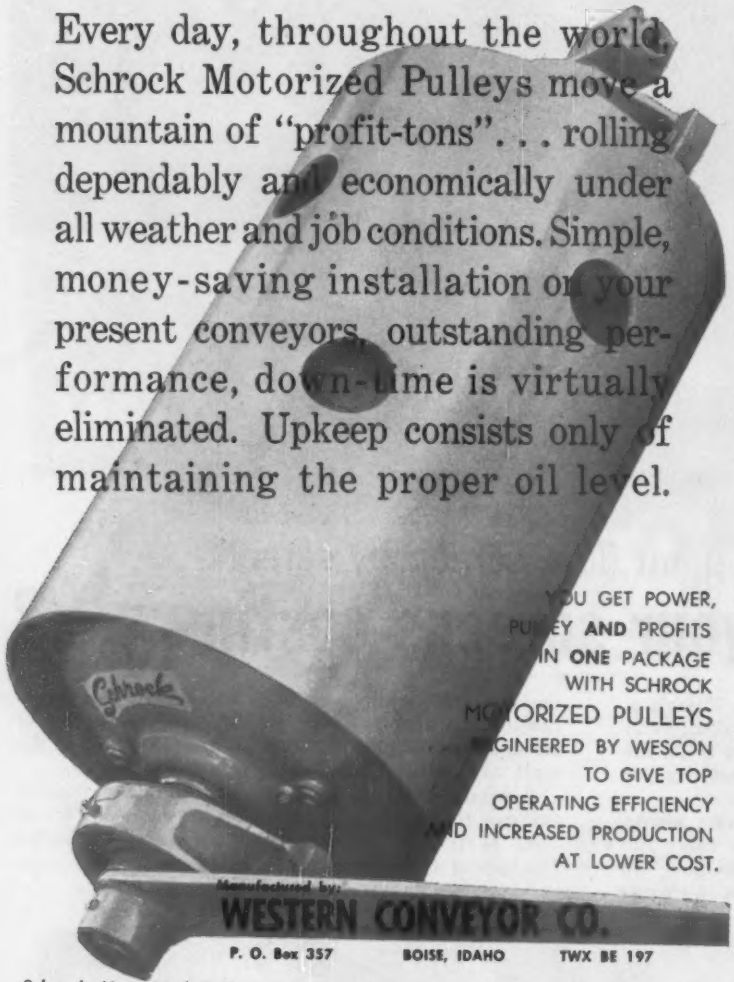
The three questions that we must answer about fossil (conventional) fuels, Dr. Currie said, are: Can we produce enough of them, can we transport them to where they are needed, and can we do the whole business cheaply enough. For one thing, he said, the cost of fossil fuels is almost certain to rise, the current glut of fossil fuels being only a temporary condition.

Reviewing the commercial nuclear picture, Dr. Currie admitted that commercial developments in atomic energy have fallen far short of hopes and expectations. But, he said, "Real progress has been made."

For one thing, the U.S. will have, by the end of 1961, three large nuclear power plants, capable of producing more than 500,000 kw. These plants, "the bellwethers" of the industry, will represent an investment of $250-million, and will need the equivalent of 300,000 tons of Colorado ore to start up and 125,00 tpy to operate. Furthermore, American "know-how" in nuclear technology has advanced so far that organizations from other nations have been willing to buy American patented ideas and engineering design services. Four reactor concepts have been developed to a point where they can be built with assurance of success: the gas-cooled graphite-moderated reactor, basis of Great Britain's nuclear power program; the pressurized water reactor, used in U.S. nuclear submarines; the boiling-water reactor; and the sodium-cooled reactor.

Quoting the words of Rep. Chet Holifield of California, chairman of the Joint Congressional Committee on Atomic Energy, Dr. Currie made two points. The uranium industry has shown that it can produce far more raw materials than military and civilian users demand. The bright side of this picture is that developers and investors in nuclear power know that enough raw material will be available to support their industry. They did not know this a few years ago. On the other hand, though, uranium producers must prepare to sell in a competitive market where the supply exceeds the demand. The uranium-producing nations, even more than the rest of the world, have reason to push development programs to see that commercial nuclear power production comes soon.

Every day, throughout the world, Schrock Motorized Pulleys move a mountain of "profit-tons"... rolling dependably and economically under all weather and job conditions. Simple, money-saving installation on your present conveyors, outstanding performance, down-time is virtually eliminated. Upkeep consists only of maintaining the proper oil level.



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P-D Refines Copper with Re-formed Natural Gas

THE USE of re-formed natural gas in place of green poles during the reduction step is a significant advance in the art of copper refining. The patented process, developed and put into practical use at the smelter of Phelps Dodge Corp., Douglas, Ariz., is the result of a comprehensive research program. Key unit of the process is a plant manufacturing re-formed gas for the two anode furnaces at the smelter refining converter copper. Air re-forming is done at this plant, and this process was chosen over that employing steam as a re-former for several reasons, of which simplicity of operation, cost and heat balances are the most important.

The plant occupies an area of 20x40 ft and has a height of 25 ft. It is adjacent to the anode department of the smelter and the re-formed gas is piped to the anode furnaces.

The company has designed gas re-forming plants for the Ajo and Morenci smelters. Operating costs at Douglas have been reduced materially since installation and

P-D Refines *(Continued)*

use of the gas reforming plant. The plant is designed to operate unattended. Some intangible advantages gained by using the reformed gas in place of poles include improved safety, improved housekeeping, elimination of storage space for poles in the converter aisle, no fire hazard, no handling of load on the converter cranes, and possible reduction of labor force.

Modernization Plan Is Under Way at Anaconda

A $6-MILLION replacement and modernization program, intended to make Montana smelting and mining operations competitive in the world copper and zinc markets and to stabilize employment, is under way at the Anaconda smelter of the Anaconda Co. E. I. Renouard, vice president of the company in charge of western operations and W. A. Emanuel, manager of the Anaconda Reduction Works (i.e. the Anaconda Smelter), who announced details of the program July 9, said:

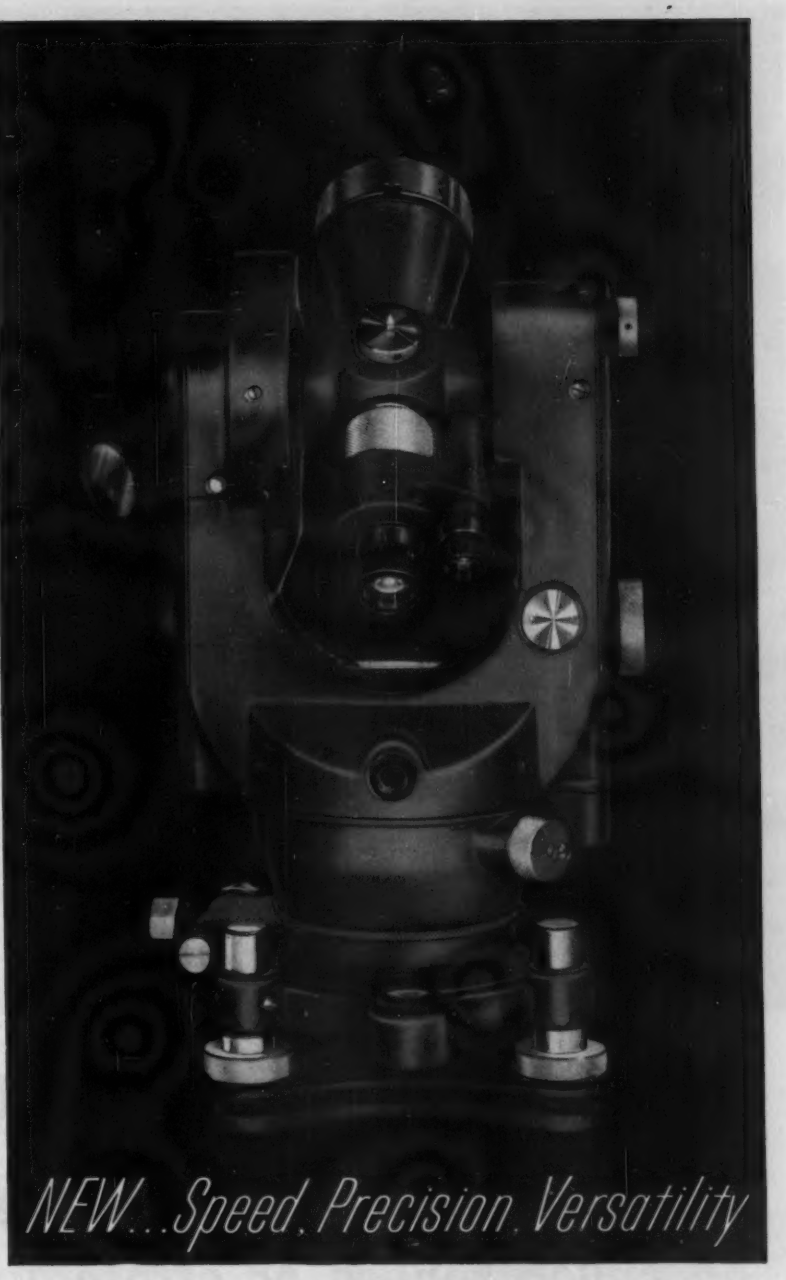
"Improvements in copper smelting facilities and other operations, which will increase the efficiency of the plant and permit higher recoveries of metals from the ores treated will help make Montana metals competitive with those produced in other parts of the world. This is part of our answer to the problem of high costs which have constituted a serious threat to our mining and smelting operations in Montana for some time. Completion of the program will improve our competitive position and provide a firmer base for steady employment in our Montana operations."

Anaconda Pres. Charles M. Brinckerhoff, in a recent address before the New York Society of Security Analysts, listed the Anaconda plant modernization and the Butte deep level mining development project as the company's major capital expenditures planned in Montana at this time.

The reduction plant program, one of the largest undertaken at the Anaconda works in many years, is scheduled for completion in 1961. Some phases of it are already completed and others are now in various stages of completion or will be started soon. The plant processes ore from the company's mines in Butte and Nevada as well as ore and concentrates received from toll customers.

In addition to replacement of old-style equipment and improvements in metallurgical operations, a large modern system is being installed to recover water from waste tailings and re-use it in the concentrator. Highlights of the program follow.

The car dumper at the East Anaconda tipple where ore cars from Butte are turned upside down for unloading will be replaced. The new installation will make for easier handling of the large 80-ton cars now in use on the Butte, Anaconda and Pacific Railway. This work is scheduled later this summer.



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At the Detroit mine of the International Salt Company, 2000 feet of Acme-Hamilton "Super Service" conveyor belting is being used to haul rock salt from the primary crusher to a mine preparation plant and then to the shaft bottom for loading on skip hoists. During twelve years of continuous operation, the belts have handled over 12 million tons of coarse, abrasive rock salt without appreciable wear, splice failure or stretching. Covers and edges are still in excellent condition and these belts show no signs of needing replacing for many years to come.

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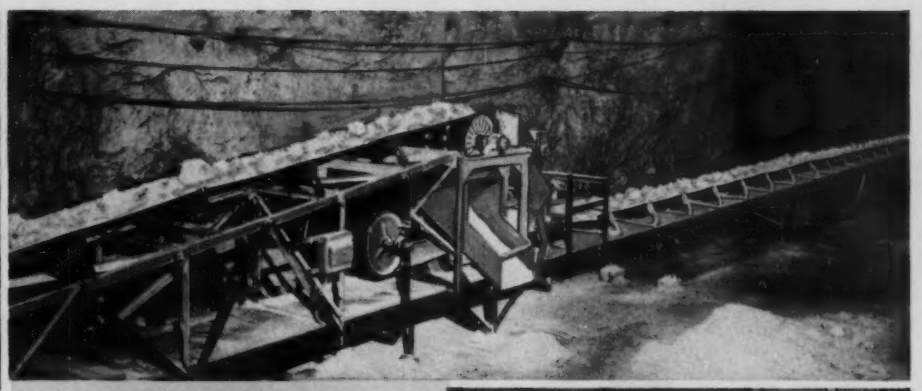
Like many mine operators who depend upon the belting they buy to help maintain a constant flow of production from the mine heading to the refinery, the International Salt Company chose Acme-Hamilton "Super-Service" conveyor belting. Years of faithful service—free of downtime for repairs and maintenance—are proof of the excellence of their choice.



Acme-Hamilton "Super-Service" conveyor belting

Acme-Hamilton conveyor belting can give you the same faithful service and low level maintenance costs through its marked superiority of materials and construction. The "Cushion Covers", for instance, are compounded to meet your job requirements; from heavy, jagged loads to light, abrasive materials. Heavy, reinforced edges are standard. A breaker fabric, for extra cushioning, can be included. Fabric plies are impregnated with extra rubber to add strength. Rubber skim coat, inserted between plies, acts as a resilient bed.

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Lima Type 2400 with 110-ft. boom and 7-cu.-yd. bucket owned by Zacherl Coal Co., Inc., of Oil City, Pa., strips 50 to 70 ft. of overburden, mostly rock, at Williamsburg, Pa.

We liked it so well we bought another!

"The Lima 2400 is a high-production, low-downtime, top-quality machine. In my opinion, it can do a stripping job better than any other machine on the market today. What more could an operator want!" So says Joseph Zacherl, a partner in the Zacherl Coal Co., Inc., of Oil City, Pa. What's more, he backs up his opinion with action. He bought his first Lima 2400 in 1958 and was so satisfied with it that he bought a second one in June 1959.

What makes him feel this way? His machines work two 10-hour shifts a day, removing about 14,000 yds. of overburden, consisting mostly of rock from 50 to 70 ft. deep. That's really hard digging for any machine. Yet in the first 10 months of use, maintenance costs on the machines totaled less than $500!

But that isn't the only thing that sold this customer. Before he bought his first Lima 2400, he toured the Lima plant. He found out, as you can too, that no shortcuts are taken. Lima builds each part to stand up under heavy punishment and have a wide margin of safety. Lima induction-hardens the principal wear points of its machines, uses anti-friction bearings instead of bushings, makes clutch and brake mechanisms extra heavy for long wear, and adequately powers its machines to do a real high-production job.

These construction details are included in all Lima machines . . . and there's a type and size for every mining need. Draglines variable, shovels to 8 cu. yds., cranes to 140 tons.

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Anaconda *(Continued)*

An anti-freeze system to spray ore cars also will be installed this fall at the tipple. In cold weather, ore cars are thawed out by banks of infra-red heaters before they are sent back to Butte. This will help prevent freezing of ore in the cars.

Further improvements are being made in the dust-collecting equipment at the East Anaconda crusher. Electronically controlled conveyors and bins are contributing to a more efficient operation which minimizes spillage in the crusher and concentrator operations.

Several regrind mills are being replaced by the installation of three new ball mills, each 9 ft in dia and 14 ft long driven by 900 hp motors. There also will be six new 28-cell flotation machines and auxiliary equipment. The new mills will permit treatment of a larger tonnage and provide a finer grind and a higher grade of concentrate. This project is scheduled for completion in August. Ball-making equipment is being modernized in the foundry to assure the economic production of high quality balls for the regrind mills.

One of the largest projects of the program is modernization of the roaster and reverberatory furnace departments. Two modern fluid bed roasters will be installed to take the place of 12 of the old-style roasters. They will provide a larger capacity and greater efficiency. Mixing of dry and wet material will give a dust-free feed for the reverberatory furnaces. A conveyor belt system to carry the mixture from the roaster building to the reverberatories will replace the antiquated tramming system and allow a cleaner operation.

New conveyors and surge storage bins will eliminate much of the dust and gaseous condition and, at the same time, will permit capacity operation of the furnaces. New matte tapping facilities also are being installed to reduce the amount of escaping gas and decrease the amount of scrap material which has to be melted. Modern burner equipment for the reverberatories will result in improved efficiency in the burning of gas.

Newly-designed smoke controls are being installed on hoods of the converters. Casting equipment for making copper anodes is being modernized. Numerous fans, ducts and dust collectors are being installed to prevent air pollution. When this work is completed, the Anaconda plant will be one of the best ventilated in the U.S.

The new tailings and water recovery system involves the installation of a hydroseparator, a tailings thickener, a pumphouse and miles of pipe lines. The smelter must dispose of about a million tons of tailings each month.

Tailings from the concentrator will pass through a 48-in. pipeline 4,000 ft long to the hydroseparator where coarse material in the waste will be settled to the bottom and fed out through a 16-in. line for construction of dam facilities in the new disposal area. There will be 41,000 ft, or approximately eight miles, of 16-in. line.

The overflow from the hydroseparator, consisting of fine material and water, will go to the thickener. There, after another settling process, the waste will pass through a 36-in. pipeline, 3,000 ft long, to existing ponds and then by ditch to the upper level of the new pond area.

The new disposal area, comprising some 4,000 acres, is within the triangle formed by the planned route of the new Butte-Anaconda highway, the Warm Springs-Anaconda road and the Crackerville-Warm Springs route. It is estimated that the area is large enough to receive smelter tailings for the next 50 to 60 yr.

Overflow water from the thickener will be pumped back to the concentrator for re-use. Approximately 17-million gal of water a day will be recovered, or more than one-fourth of the plant's daily requirement of 58-million gal. The thickener, now under construction, is 370 ft in dia and is among the largest, if not the largest, in the world. It will form a pool covering about two and a half acres. A steel overpass is being erected to carry the tailings pipelines over Highway 10-A east of the plant.

The new disposal system, with its large area to store more than 40,000 tons of waste tailings produced each day, will be important in the company's extensive

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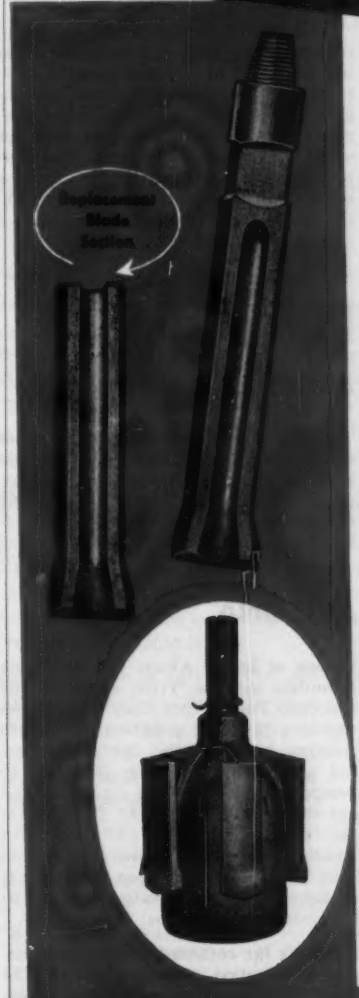

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Available also, as an added economy, are SPANG REPLACEMENT BLADE SECTIONS in the same grades of steel, and uniform forge section, for welding to pin and collar sections of original bits when long service has worn the integral blade to a point where replacement is desirable.

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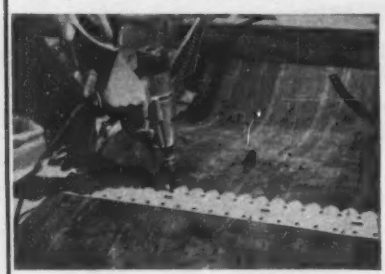
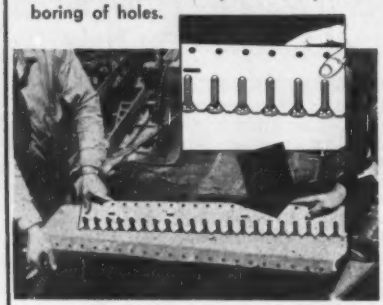
Your two man belt team can now join a belt 30" wide in 15 to 20 minutes . . . using the new FLEXCO Power Tools.



The FLEXCO Power Tool Boring Bit used with electric or air impact tool speeds boring of holes.



New FLEXCO Templet positions bolts for quick joining of belts. Reaching under belt has been eliminated.

Running down nuts is fast with the new FLEXCO Power Wrench used with electric or air impact tool. Two Bolt Breakers are used together to complete the joint.

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Anaconda *(Continued)*

water pollution control system. Company officials believe it, along with control measures, will assure a clear runoff to headwaters of the Clark Fork River. Modern instruments have been installed to provide a continuous analysis of acidity in the water at the overflow of the Warm Springs settling ponds and provisions have been made for treating all water before it is released into the river. This is an extension and improvement of the pollution control program the company has carried on for several years.

Sand fill for the Butte mines will be produced from tailings in the pipelines by the use of cyclones. The fill, mixed with water, is pumped into the mines to fill old workings and prevent fires.

Another phase of the smelter modernization is the erection of a new crushing plant for miscellaneous material to replace the old lime rock crushing plant which was built in 1902. The new plant is due to be completed this fall.

The present Anaconda smelter began operations in 1902 and over the years has increased in size and capacity. The plant now occupies 459 acres and includes about 600 buildings. The Anaconda plant often has set the pace for world metallurgical progress. The current modernization program is one of a series during the years which have made the smelter one of the largest and best known of its kind in the world.

IN THE U.S.

ALASKA

The first shipment of uranium ore from the Kendrick Bay Mining Co. pit and adjacent claims at Bokan Mountain arrived at Lakeview, Ore., as JOT Mining Co. returned Alaska to uranium production.

ARIZONA

Bureau of Indian Affairs and the White Mountain Apache Tribe approved the Colorado Fuel & Iron Corp. bids for an exclusive prospecting permit on eastern Arizona Apache Indian lands. The permit gives the corporation the right to prospect for all minerals except oil and gas on approximately 188 sq miles in the northwestern part of the Fort Apache Indian Reservation. Colorado Fuel plans to develop iron ore deposits on these lands, but expects to find asbestos, manganese and coal as well.

Arizona's tax commission has placed assessed valuation totaling $253,197,154 on state mining properties for 1960. This is an increase of almost $14-million over 1959 figures.

Major increases, with 1960 valuations listed first and 1959 valuations listed second, are:

Kennecott Copper Corp: in Gila county, $12,231,750 and $7,621,885; and in Pinal county, $25,527,674 and $20,527,260;

Duval Sulphur and Potash Co., in Pima county: $10,910,664 and $6,959,821;

Shattuck Denn Mining Corp. in Yavapai county: $2,519,377 and $1,504,794.

The state tax commission sat as a board of equalization during the first week of August to hear protests.

Industrial Uranium Corp., which was founded during the uranium boom by a group of Salt Lake businessmen with no mining experience, had net profits for last fiscal year of $1,153,229.

Robert M. Schubach, a jeweler of Salt Lake City who is president of Industrial, said these profits for 12 months ended March 31, 1960 compared with a loss of $447,819 for previous fiscal term.

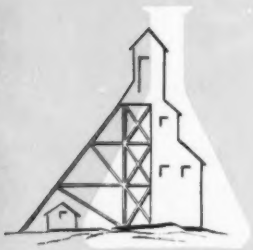
However, in 1959 period, the firm took $447,819 in developmental allowances on mines in the Monument Valley area in extreme northern Arizona. Actually, the firm would have had a profit of $258,660 in fiscal 1959 if the deductions had not been taken.

Mr. Schubach said for the fiscal period ended March 31, 1960, Industrial had gross sales of $3,676,634 versus sales of $1,028,220 for 1959 term. Production is currently from the Starlight, Walter Chief and Sunlight mines at current rate of 6,000 tons monthly of ore.

CYANAMID

Reagent News

"ore-dressing ideas you can use"



Ever-Widening Use of Cyanamid 800 Series Promoters

- **for Floating Fe_2O_3 from Non-Metallics**
- **for Concentrating Low-Grade Iron Ores**

HERE'S THE BOX SCORE ON CURRENT USE OF CYANAMID 800 SERIES PROMOTERS:

Feed	No. of Plants	Feed	No. of Plants
Glass Sand—Feldspar	18	Garnet	1
Iron Ore	3	Columbium	1
Chromite	3	Kyanite	1
Barite	2	Manganese	1

At glass sand, feldspar operations, iron-bearing minerals are floated away after the feed has been conditioned with approximately 0.3 lb./ton AERO® Promoter 824 or 825 and 0.7 to 1.0 lb/ton AERO® Promoter 801 with up to 0.5 lb/ton fuel oil. Sulfuric acid is used to lower the pH to 2.5-3.5 during conditioning. Pulp density is kept high and AEROFLOAT® 31 Promoter is added as an auxiliary frother.

This 800 Series promoter combination will preferentially float both magnetic and non-magnetic iron-bearing minerals but may not remove iron occurring as mineralogical inclusions in the silica grains. Surface stain can usually be removed by a preliminary attrition scrub and desliming, with or without an acid leach.

Glass sand products as low as 0.02% Fe_2O_3 are produced regularly at many operations. In cases of silica occuring with feldspar, after removal of the iron-bearing minerals by flotation with 800 Series Promoters, both silica and feldspar products can be produced by the standard feldspar flotation method. This involves conditioning of the low-iron pulp with HF and flotation of the silica from the spar with a cationic collector such as AEROMINE® 3037 Promoter and an AEROFROTH® Frother, as required.

For low-grade iron ore concentration, a typical flow scheme of a large U.S. iron-ore beneficiation plant combines gravity separation with froth flotation. At this plant, gravity concentrates are produced by spirals. Spiral tailings are ground and deslimed in cyclones to produce a flotation feed running 30 to 35% Fe. Conditioning is done at 65% solids with 3.0 lb/ton H_2SO_4 to maintain a pH of 5.0; approximately 1.9 lb/ton AERO® Promoter 899; 0.7 lb/ton fuel oil and 0.4 lb/ton tall oil.

Flotation concentrates are cleaned and recleaned with the addition of up to 1.4 lb/ton sodium silicate. Final concentrates from flotation feed running 30 to 35% Fe now average 58 to 60% Fe with 6 to 8% SiO_2. Iron recovery runs 65 to 70%.

• • •

The 800 Series Promoters have also shown good results on a laboratory scale for treating bauxite, fluorspar, tin, oxide copper, dolomite, phosphate, tungsten, celestite and lithium ores.

For further information on flotation with the Cyanamid 800 Series Promoters, get in touch with the Cyanamid office nearest you.

CYANAMID DE MEXICO, S.A. de C.V.
Apartado Postal 233
Mexico 1, D.F., Mexico

CYANAMID OF GREAT BRITAIN LTD.
Bush House, Aldwych,
London W. C. 2, England

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Of. 7, Lima, Peru

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Melbourne, Australia

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Yuraku-Cho, Tokyo, Japan

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Cyanidation Process Chemicals
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Surface Active Agents

High Explosives
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Caps
Electric Blasting Caps
Blasting Accessories

AMERICAN CYANAMID COMPANY
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Proof from Jones & Laughlin!

Ni-Hard liners keep their contour after grinding better than 2 million tons of ore

Here's photographic proof from the Benson Mine, New York Ore Division of Jones & Laughlin Steel Corporation in upstate New York.

Ni-Hard liners keep their contour — resist abrasion — provide a slow, uniform wear rate — are good to the last ¼ inch.

You could never tell by looking at them, but these Ni-Hard* nickel-chromium-iron alloy shell liners have been grinding iron ore *for more than 2 years.* With better than 2 million tons of ore behind them, they've still got plenty of tonnage left in them!

Used in J&L's ball mills and rod mills —at the feed end as well as the discharge end—these Ni-Hard liners are delivering *superior abrasion and wear resistance.* They're saving many thousands of hours of downtime, many thousands of dollars in repair and replacement.

Try a set of Ni-Hard liners and see for yourself how the abrasion and wear resistance of Ni-Hard can increase *your* tonnage, can lower *your* costs.

Our detailed 58-page booklet, "Engineering Properties and Applications of Ni-Hard" suggests many ways to put this versatile and long-lasting material to work profitably. Say the word and we'll be glad to send you a copy.

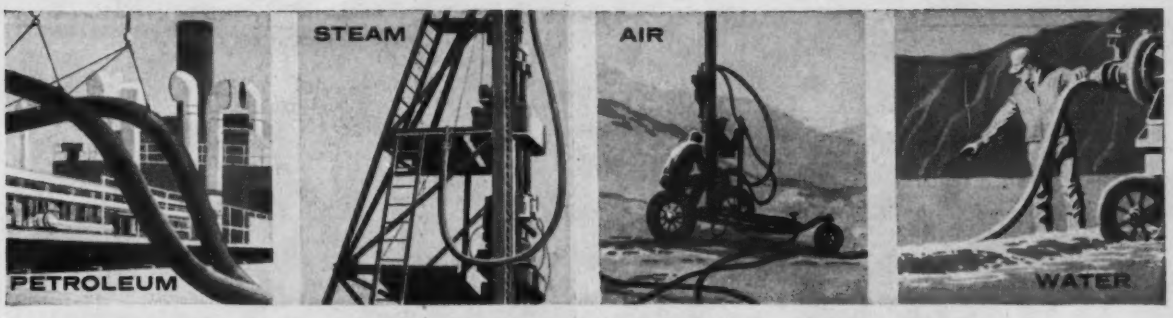
*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.

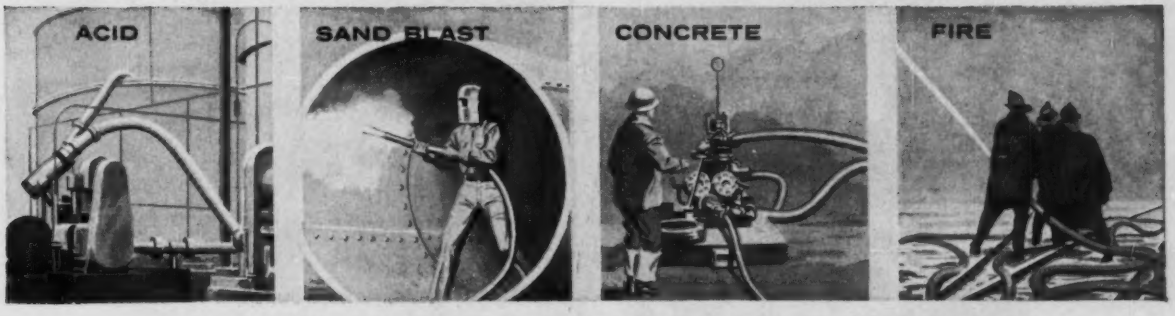
67 Wall Street INCO New York 5, N. Y.

NI-HARD®

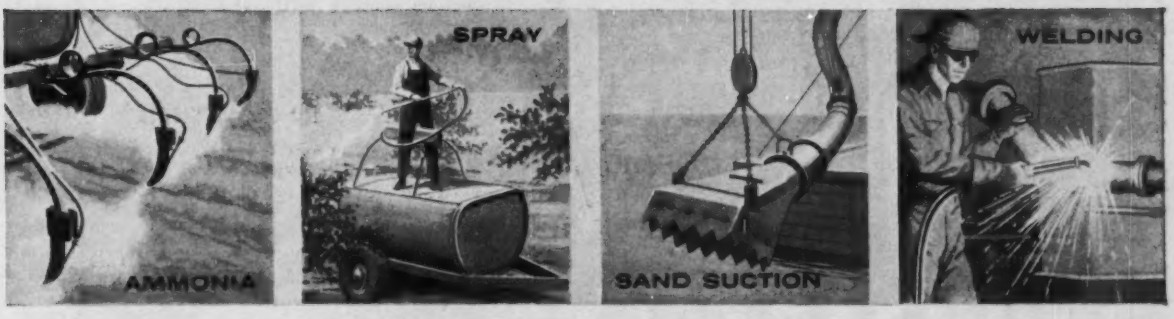
NICKEL MAKES CASTINGS PERFORM BETTER LONGER



BOSTON HOSE...



LONG LINE OF



TOP PERFORMERS

The BOSTON line includes standard and custom-built hose from 3/16″ to 42″ I.D. Each hose is manufactured to exacting quality standards prescribed by our progressive Research & Development Department. They assure you a superior hose for your most rigid requirements. BOSTON means honest value, top performance—the best hose for your needs. Let us demonstrate how BOSTON serves you best!

AMERICAN BILTRITE RUBBER COMPANY
BOSTON WOVEN HOSE & RUBBER DIVISION
BOSTON 3, MASSACHUSETTS

BOSTON

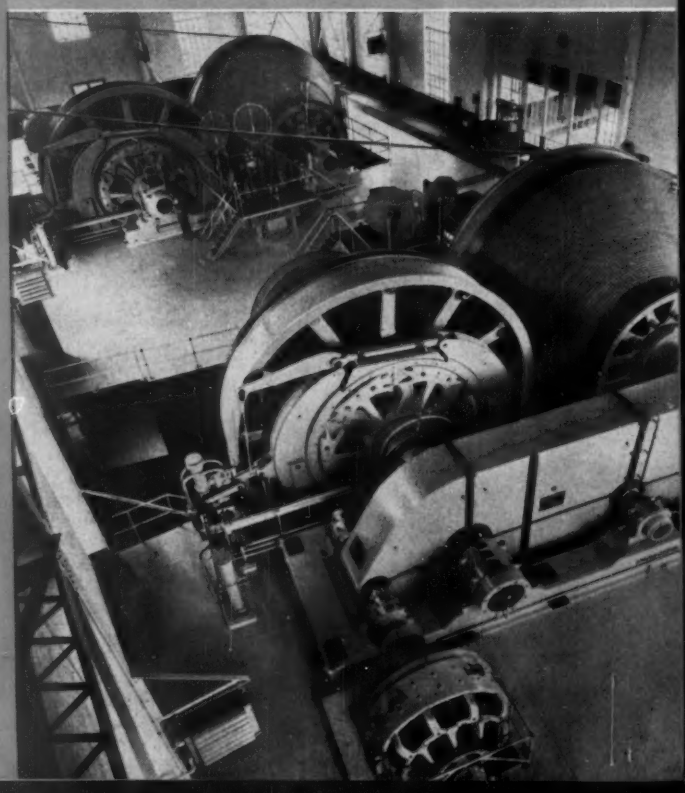
HOW NORDBERG MACHINERY SERVES THE MINING INDUSTRY

IN POWER GENERATION

Nordberg engines are built in sizes ranging from small power units to over 12,000 horsepower in a single engine . . . and are available for Diesel, Duafuel® and Spark-Ignition Gas operation.

IN HOISTING

Nordberg has an established reputation second to none, and can furnish both conventional and friction type mine hoists for men and material, to meet specific requirements.



NORDBERG MFG. CO.
Milwaukee 1, Wisconsin

SYMONS . . . A Registered Nordberg Trademark Known Throughout the World.

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MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS • SAN FRANCISCO
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LONDON • MEXICO, D. F.

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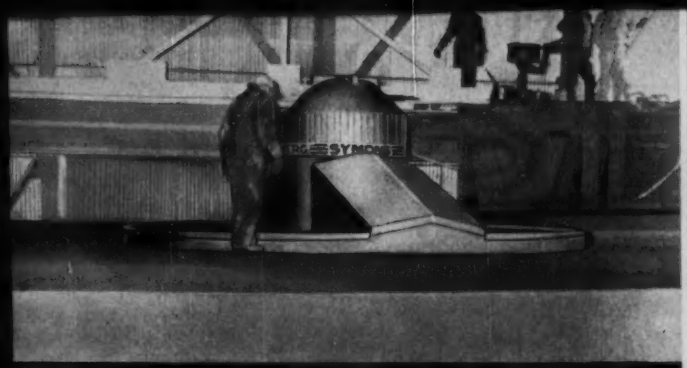
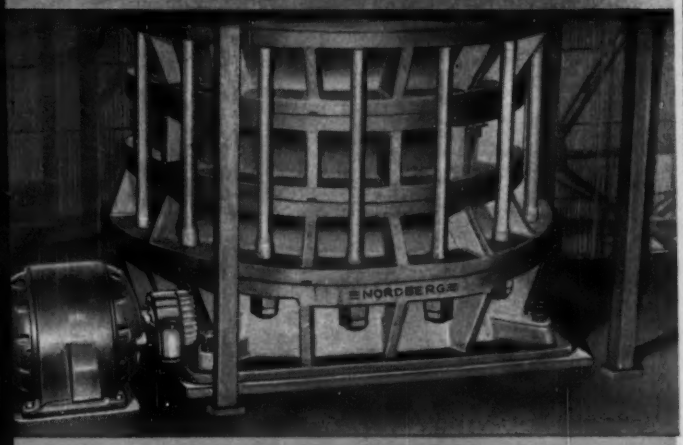
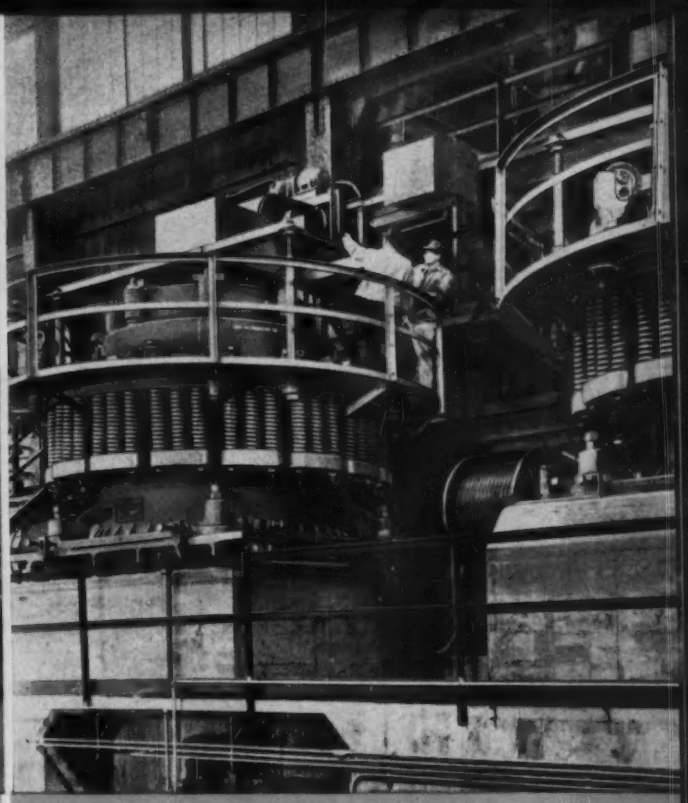
B150-R







IN PRIMARY CRUSHING

Symons® Primary Gyratory Crushers are built for big tonnage, heavy duty primary breaking in 30″, 42″, 48″, 54″, 60″ and 72″ feed opening sizes. Capacities to 3500 or more tons per hour.

IN FINE REDUCTION CRUSHING

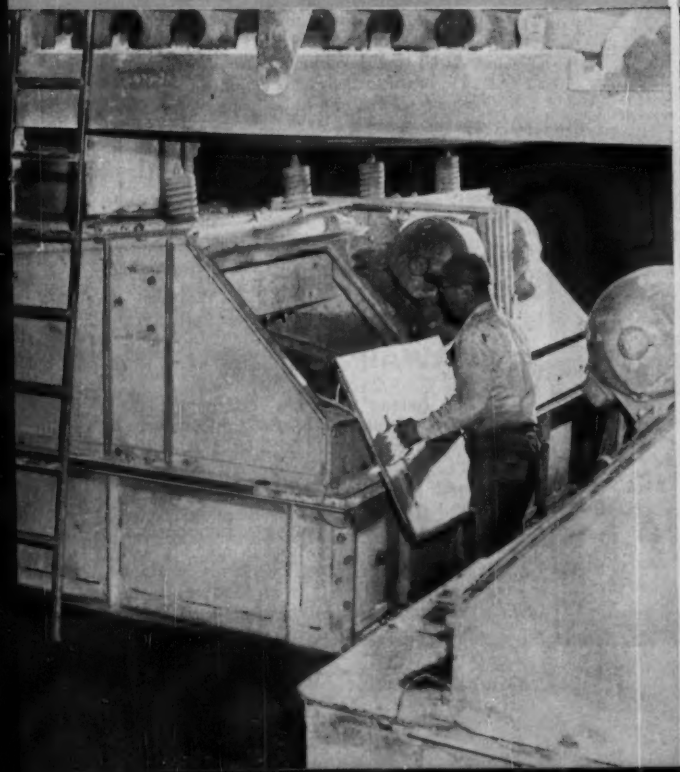
Symons Cone Crushers, the machines that revolutionized crushing practice, are built in both Standard and Short Head types, in sizes from 22″ to 7′ in diameter. Capacities from 6 to 900 or more tons per hour.

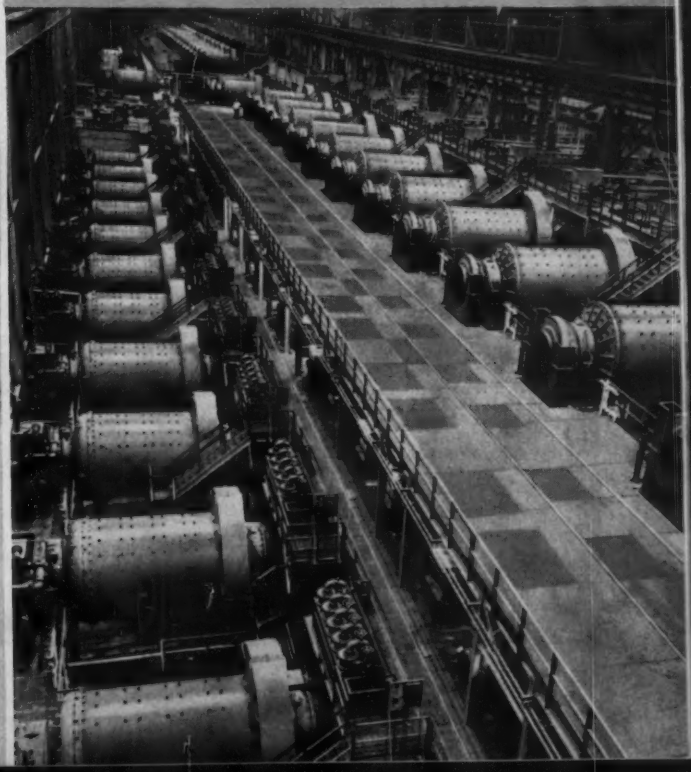
IN SCREENING

From scalping to fine screening, there is a Symons Screen built to do a better job at low cost. Let Nordberg experience help you select the screen best suited to your needs.

IN WET AND DRY GRINDING

Nordberg Grinding Mills include Rod, Ball, Pebble, Tube and Compartment types, in sizes from 6′ to 13′ in diameter and up to 50′ in length.





BONDED BUY

NOW AT YOUR CATERPILLAR DEALER...

Big Bargains

IN USED EQUIPMENT!

Is your present equipment line-up adequate to handle your job? See your Caterpillar Dealer! He has the biggest selection of top values in town . . . nearly all makes, all sizes, all models, all conditions . . . priced to sell with financing tailored to meet your needs!

No guessing or gambling on your part. Your Caterpillar Dealer reconditions, classifies and warrants most of his used units. You know what you're getting . . . and you're protected . . . with these three types of buys:

1 **A "BONDED BUY"** Cat-built machine, the most productive used equipment you can buy. Carefully checked, it is backed by his written bond up to $10,000, assuring you parts and service protection for the warranty period.

2 **A "CERTIFIED BUY"**—a written warranty covering units of any make in good condition.

3 **A "BUY AND TRY"** deal—a written money-back agreement on machines not in the above two classifications.

Only a Caterpillar Dealer will provide you with "Bonded Buy" protection. He backs his machines with prompt service and parts you can trust. Look him up in the Yellow Pages . . . look over the machines in his used equipment lot. You'll find the best buys in the market there!

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

BEST USED EQUIPMENT BUYS ANYWHERE

Arizona *(Continued)*

It is expected this rate will be maintained during 1960, although the Starlight will be mined out. However, a 450-foot incline shaft is being sunk on a new ore body, the 50,000 ton *East* Starlight reserve, with mining to start in six months. Industrial will complete its uranium program by March 31, 1962.

CALIFORNIA

Quarterly report of the U.S. Borax & Chemical Corp. showed sales ending June 30 up 8% over the same period last year. Net income of the firm equaled $1.17 per common share as opposed to $1 last year.

Cyprus Mines Corp. reports a six month profit ending June 30 up 57¢ per share over 1959 from $1.34 to $1.91. New chemical, timber and cement ventures which the company entered in 1959 are in development stages and did not contribute to current earnings, the firm says.

COLORADO

AEC extended to Dec. 31, 1966, a uranium concentrate purchase contract with Homestake-Sapin Partners. The contract replaced the original agreement that would have terminated on June 30, 1963. Contained in the agreement is a deferral, or "stretchout," of a portion of the pre-1962 production from company controlled properties to the 1962-66 period and is effective as of April 1, 1960.

Clute Corp. has acquired all outstanding stock in the Ajax Iron Works, a custom metal fabricating firm, through an exchange of stock. Clute Engineering Div. will absorb Ajax and its employees as a part of the development program for heavy equipment manufacture. All research and development for the division will move to the Denver plant of another recent Clute acquisition, Truco Mfg. Co.

Standard Metals of Silverton will use one of the several proven processes for treatment of rhodonite developed by U.S. Manganese Corp. Standard has not announced which method it will use, but studies will speed up to coincide with actual mining of rhodonite beginning next year.

HAWAII

The Bureau of Mines reports that the value of mineral output in Hawaii increased to a record high of $7.6-million in 1959, from $6.3-million in 1958. Sand, gravel and stone, sold or used to meet the fiftieth state's accelerated building and paving requirements, reached 3.5-million tons in quantity and $6.7-million in value in 1959, compared with 2.8-million tons at $5.5-million in 1958. Increases in the output of clays, lime, trachyte and volcanic cinder were

Autocar Way. All rotating parts, including rear wheels, are balanced both individually and in assembly.

Better Balance...as you find it in the "World's Finest"

Better balance means improved performance. Means less maintenance. Means more driver comfort.

Better balance is an exclusive Autocar quality. Every rotating component in an Autocar is balanced with meticulous care. Hubs and drums, wheels, front and rear tires, for example, are balanced both individually and in assembly. Drive shafts are balanced at speeds up to 3,000 rpm to within *one ounce inch.*

That's balance. That's quality. That's how Autocar provides the greatest performance. Why take less than the "World's Finest"?

Autocar
"World's Finest"

Division of
The White Motor Company, Exton, Pa.

TIMED TO PROVE FASTER HAULING

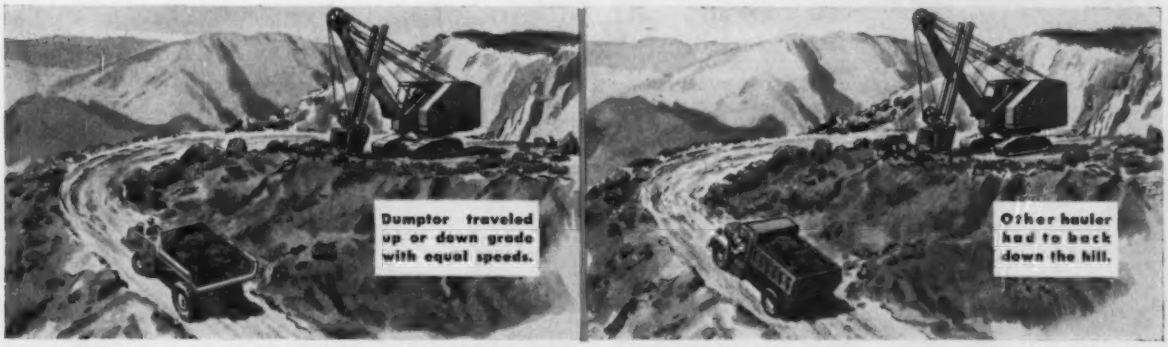
On the job described here, a 15-ton Koehring 100 Dumptor was matched against another leading rear-dump hauling unit. The Dumptor out hauled its competition by an amazing margin — actual time studies (see table) showed the Dumptor making almost twice as many round trips! Why the big difference? One reason was that the competitive hauler had to back down the grade — as one observer said, "You could smell the brakes burning."

Check out the 100 Dumptor in your own operation. Here's a 30,000 lb. payload machine with a big 10′ x 10′9″ body. Instantaneous or controlled dumping. No turn operation. Full speed in both directions. Hydraulic clutches for direction and speed range selection combine with torque converter drive and power-steering for maximum operating ease and speed. Your Koehring distributor has all the facts. Call him for a demonstration.

HAUL UNIT	HAUL TIME			DUMP TIME			RETURN TIME			AVERAGE TRIP
TYPICAL TRIPS	#1	#2	#3	#1	#2	#3	#1	#2	#3	
15 TON DUMPTOR	:48	:53	:49	:07	:06	:04	:37	:43	:48	1 min. 38 sec.
18 TON REAR DUMP HAULER	1:25	2:00	1:53	:14	:16	:17	1:12	1:09	1:14	3 min. 13 sec.

Pivoting seat
2-way controls, full visibility in both directions. That's the key to faster hauling with the Dumptor!

MODEL 100 | 15-TON DUMPTOR



Test of Dumptor vs. rear dump hauling unit on job covering 603 feet total one-way haul with 204 feet of total distance on a 20% grade.

See your distributor about the
KOEHRING EQUIPMENT SHOW
Waukesha, Wis., week of Sept. 19.

MORE WORK CAPACITY
MORE PROFIT PER DOLLAR INVESTED...

KOEHRING
DIVISION OF KOEHRING COMPANY
Milwaukee 16, Wisconsin

DESIGN KNOW-HOW PUTS PRODUCTION PLUS IN SHIP LOADING SYSTEM

Barber-Greene solves challenging gypsum handling problem at lowest initial and operating cost

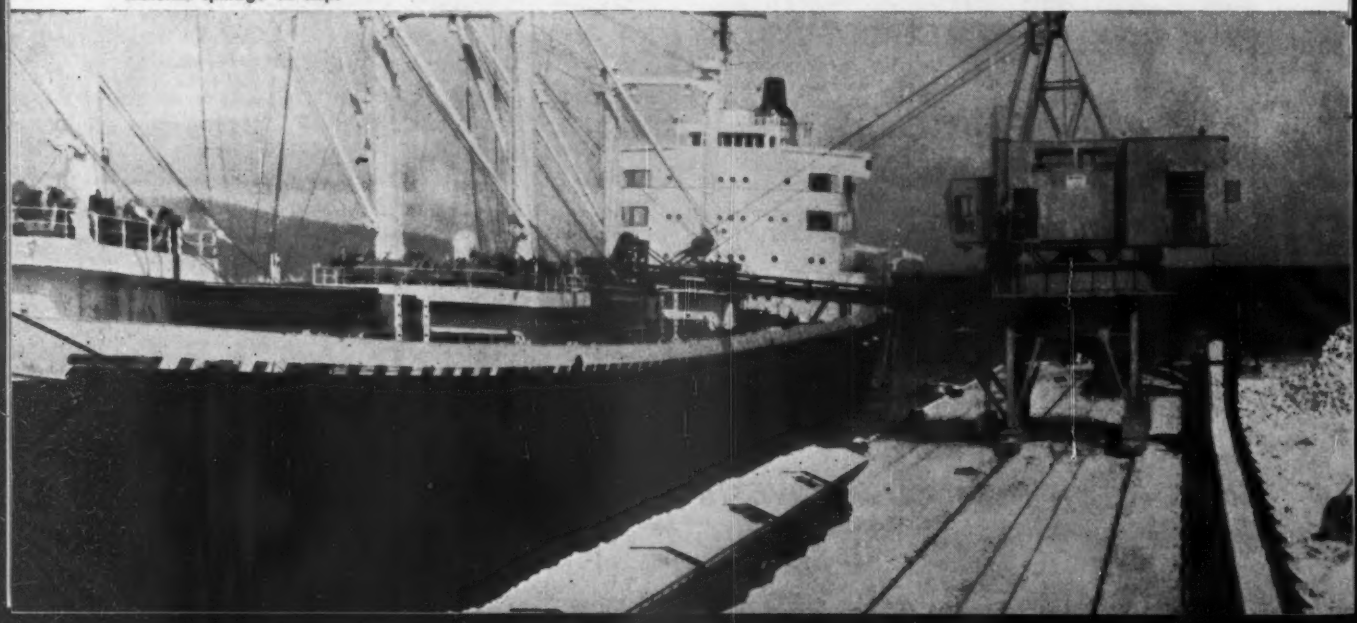
PROBLEM: Design system to unload railroad cars, stockpile 100,000 tons of material in limited area and load ships at Latin American mine and processing plant.

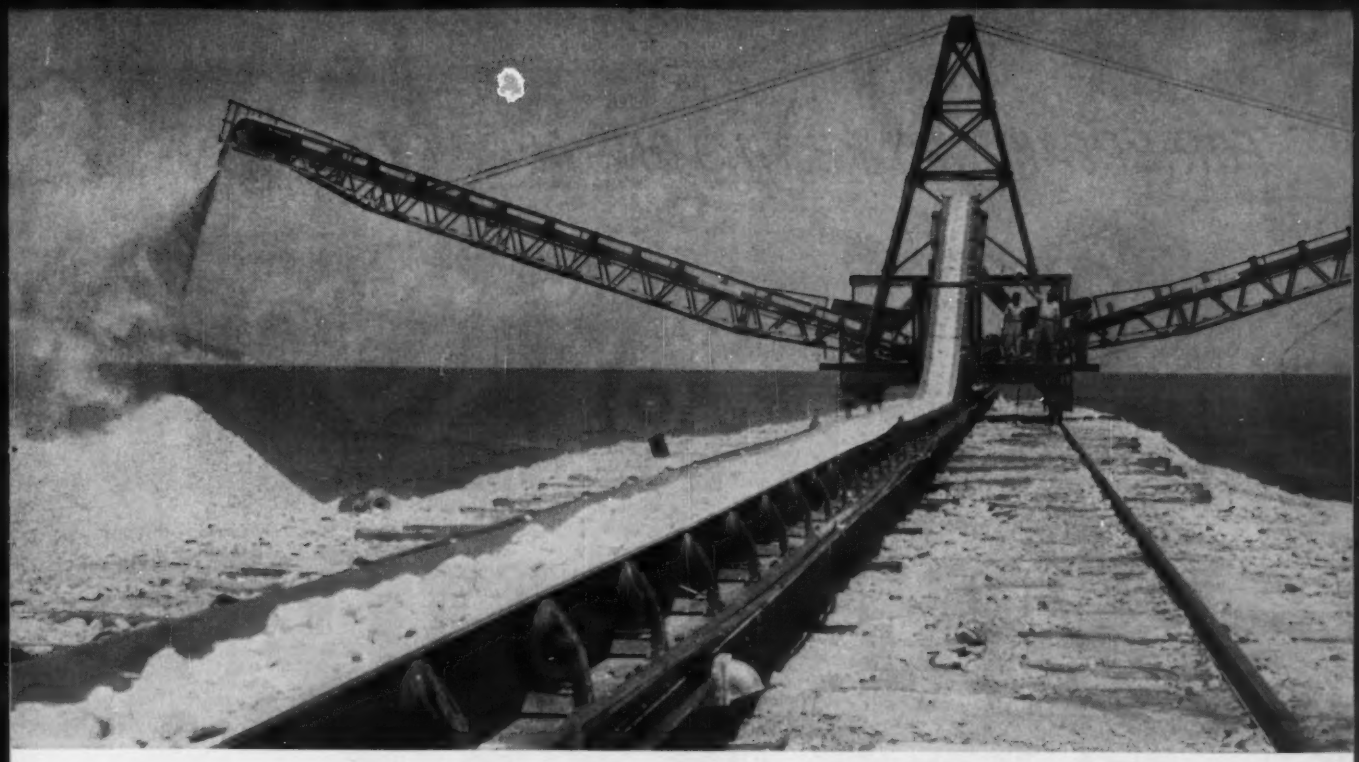
SOLUTION: Barber-Greene engineers developed several designs and recommended the system that met the customer's production requirements and held initial investment to a minimum. And by drawing on 40 years of conveyor experience, Barber-Greene engineers were able to utilize heavy-duty standardized components for over 70% of the job. Operators found the system so dependable and easy to operate that estimated loading time of ships was reduced 25%. Owner benefited two ways: increased production and reduction of shipping costs due to shorter ship loading time charges.

Barber-Greene engineers first made an over-all operational analysis of material handling at both terminal and mine, seven miles away. Such an analysis, an important part of Barber-Greene's service, allowed both customer and engineers to establish present and future requirements and better judge the relative merits of the recommended system.

This customer's satisfaction with his installation

Barber-Greene engineers saved owner $50,000 by revamping old whirly crane as base for 42" conveyor shown loading gypsum reclaimed from stockpiles. Extra wide belt eliminates material spillage on ship.





is best indicated by the fact that he recently placed an order for additional Barber-Greene Conveyors to expand the terminal operation.

Call your Barber-Greene conveyor representative for a sound solution to your bulk material handling problems. He offers the most efficient system that can be provided by engineers equally adept at custom engineering and standardized design. In addition, he offers undivided responsibility for preliminary and final design, fabrication and erection.

Installation at ship loading terminal features a double winged stacker mounted on a traveling tripper which stockpiles in an area 312′ long. Reclaim conveyors under piles direct material to traveling gantry at dock side which loads ships at 675 tph capacity.

Your belt conveyor equipment headquarters

Representatives in Principal Cities of the World

Barber-Greene BG

Main Office and Plant AURORA, ILLINOIS, U. S. A.
Plants in DeKalb, Illinois..Detroit..Canada..England..Brazil..Australia

CONVEYORS • LOADERS • DITCHERS • ASPHALT PAVING EQUIPMENT

MONEY-SAVING DESIGN: Three 8′ x 8′ hoppers were used to receive gypsum brought to terminal from mine by side-dump rail cars. Single hopper would have been very expensive to construct since water was near ground surface at this point.

FOR BREAKAGE LIKE THIS ON YOUR NEXT SHOT...

WHICH EXPLOSIVE?

Here's really effective blasting, the kind that gets more payload service out of all your equipment. Look at the breakage—it is uniform and thorough for easy, economical handling. The point is, uniform breakage like this doesn't just happen. Whether you are blasting in underground stopes, drifts, or shafts, or in open pits, there is a combination of explosives and blasting methods that is right for every shot.

For example, in addition to the four shown here, there are other such specially developed products as Atlas Pellets, a new form of ammonium nitrate that has both the density and sensitivity needed for efficient AN-oil blasting; Giant Gelatins for high velocity, shattering action; Ammodyte,® a new economy dynamite; and Giant "75" Primers for efficient detonation of blasting agents.

It will pay you to ask your Atlas Representative about these, and the many other products in the complete Atlas line. Working with him, you will have the advantage of his experience with the latest advances in explosives and techniques. He can help you determine the combination of explosives, blasting agents and particular blasting methods that will be the most profitable for you on every shot.

There is only one way to look at explosives costs, and that is: which explosive will give you the most payload service from all your equipment? Our blasting cost chart, slide rules and technical literature are designed to help you do exactly that. Ask your Atlas Representative about them or, write directly to:

ATLAS POWDER COMPANY
Explosives Division, Wilmington 99, Del.

ATLAS EXPLOSIVES

AMODYN,® an ammonia type explosive, is available in both high and low velocity grades. Used mainly in stoping and tunneling.

MANASITE® half-second delay electric blasting caps have the most uniform timing because of exclusive Atlas electric match.

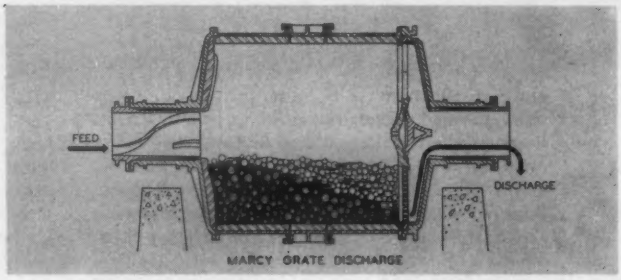
ROCKMASTER® millisecond delay electric blasting caps achieve the staggered action so important for better breakage and control.

GELODYN,® a complete series of semi-gelatins, is suitable for wet work and can be retained in upward pitching bore holes.

imagination
to originate

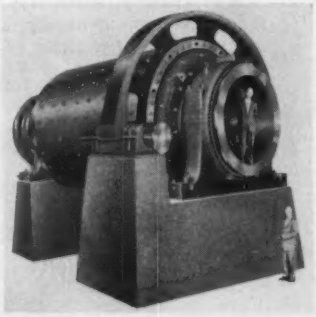
experience
to produce...

IDEAS AND EQUIPMENT FOR LOWER COST GRINDING



Low Pulp Line

Mine and Smelter developed the principle of rapid change of mill content with a low pulp line obtained through use of grate discharge in Marcy ball mills and open end feature in Marcy rod mills. This Marcy principle increases tonnage up to 33%; decreases KWH per ton.



Large Diameter

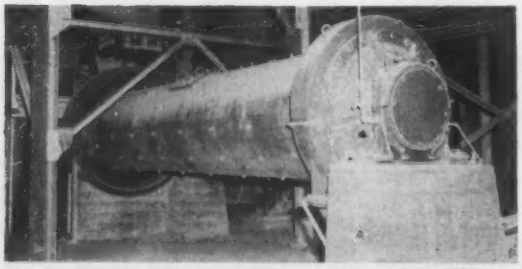
Mine and Smelter pioneered the use of large diameter mills to meet the need of specific applications where large tonnage per mill reduced initial cost, provided more efficient grinding, and resulted in a lower overall net cost per ton.

2-Stage Grinding

Mine and Smelter's research and experience has resulted in many refinements in the grinding process, one of the most significant being 2-stage grinding... adding Marcy Open End Rod Mills between existing crushing and grinding stages, or replacing fine crushing. This has proven to increase capacity, produce a better ball mill feed, and reduce overall costs.

MARCY MILLS

are available in 29 different diameter sizes, from 12" to 12'6"... all proven in the field... all built with mechanical specifications based on proven experience in the field.



Engineering for Special Applications

Engineering grinding mills for specialized applications requires the kind of imagination and experience which Mine and Smelter has developed during the 45 years it has devoted to the art of grinding. Shown is a Marcy Grate Discharge Ball-tube mill, with peripheral discharge, designed for dry grinding high-temperature calcined gypsum from 100 mesh to as fine as 5000 Blaine. This mill provides flexibility in fineness of grind and accurate, convenient means of control.

The Company that cares enough to give you the best!

Manufacturing Division

MINE AND SMELTER SUPPLY CO.

DENVER 16, 3800 RACE ST. | NEW YORK 17, 122 E. 42nd ST. | SALT LAKE CITY 1, 121 W. 2nd S. | EL PASO, 1515 11TH AVE. | ALBUQUERQUE, 701 HAINES N.W.

Licensed Manufacturers and Sales Agents in Canada, Australia, Sweden, England, South Africa
Sales Agents in Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in principal cities of the United States.

The Company that cares enough to give you the best!

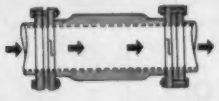
Massco-Grigsby

PINCH VALVES

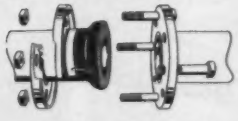
RUBBER, NEOPRENE
for Corrosion and Abrasion

- 1" to 14" inside diameter.
- Pressures to 150 psi.
- Temperatures to 200° F.
- Patented "hinged" sleeve. Recesses serve as "hinges" during compression; reduce strain and permit tight closing.

- Cannot leak or stick.
- No working parts in contact with pulp or liquid; no packing glands.



- Unobstructed flow eliminates high friction loss.
- Remote control available.
- Can be equipped for automatic regulation.



- Split flanges and patented Flex Seal ends assure perfect seal.

See Booth 302, American Mining Congress Las Vegas meeting, October, for latest advancement in valve automation.

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OFFICES AND AGENTS IN PRINCIPAL CITIES

Hawaii *(Continued)*

also substantial.

Sampling of bauxite ore from the Islands of Kauai, Maui and Hawaii was completed by the Federal Bureau of Mines in June 1959; and research on the beneficiation of the ore and the extraction of alumina was being conducted at the Bureau of Mines' metallurgy research center, Rolla, Mo., for the State Government. The Federal Geological Survey undertook additional investigations of bauxite ore on Kauai Island effective July 1, 1959. A preliminary report on the simulated mining and rehabilitation project on bauxite soils in the Wailua Game Refuge Area on Kauai Island, was submitted to the State Government during 1959 by a mainland consultant.

IDAHO

Mines of Shoshone County, Idaho, produced 1,262,620 tons of ore during 1959; and the gross value of the production was $37,452,281, according to assessable net profit valuation reports on file at the county assessor's office in Wallace. These production figures compare with 1,212,321 tons in 1958 with a gross value of $34,061,394. Fourteen mines and six leases filed reports for 1959 compared with 21 mines and six leases in 1958, the county assessor said, a definite indication of the way mining operations have faded in Idaho because of depressed nonferrous metal conditions and prices.

The year's total assessable net profit valuation was $4,604,587 for 1959 compared with $4,316,588 in 1958 and $16,827,301 in the county's high year of $16,827,301 in 1951. Highest assessable net profit figures were $1,409,733 for the Galena Mine of the Callahan Mining Corp.; $1,168,056 for the Bunker Mine of the Bunker Hill Co.; $766,483 for the Sunshine Mining Co.; $518,940 for Hecla Mining Co.; and $391,823 for the Star Mine of Bunker Hill.

These net profit valuation figures do not represent net profit in the usual sense of the term, but are more nearly the equivalent of operating profits with some additional allowances for improvements, repairs and other specific cost items, but before deductions for depreciation, depletion, federal, state and local taxes and other normal items of expense.

Federal Uranium Corp. is installing a new hoist motor and controls for a shaft deepening operation at the Conjecture Mine near Lake Pend Oreille. Sinking operations will go an additional 1,000 ft in the development work carried on during the past year to ready the property for production.

A group of northern Idaho investors headed by John Brady, Moscow attorney, has purchased the controlling interest in the old Muscovite mine of Western Mica Corp. The new firm, Ida-Mica Industrial Minerals Inc., plans to produce ground mica for use in paints, roofing materials and rubber cement.

Mascot Mines Inc. and Pine Creek Lead-Zinc Mining Co. in the Coeur d' Alene district of Idaho have effected a merger whereby Mascot will be the surviving corporation. Shareholders of the Pine Creek firm will receive one share of Mascot stock for each share of Pine Creek stock held.

The Lucky Friday Silver-Lead Mines Co. of Mullan, has placed an order with Nordberg Mfg. Co., Milwaukee, for a new hoist of sufficient size to permit operations in the mine to a depth of 5,000 ft. It will be a double drum, direct-drive model of 1250 hp with Westinghouse Electric motor controls, the firm said.

Directors of Silver Star Queens-Mines Inc., in the Hailey section of Idaho, have outlined plans for a continuation of the company's exploration program in the projected extension of the vein at the company's Minnie Moore mine. The area of the extension will be 100 to 400 ft and cost of the drift will be approximately $44 per ft.

Monsanto Chemical Co. was the recent successful bidder for 1,361 acres of phosphate land located about 18 miles northeast of Soda Springs. It is expected the land will become an integral part of Monsanto's future operations in Idaho.

Construction has been started on a

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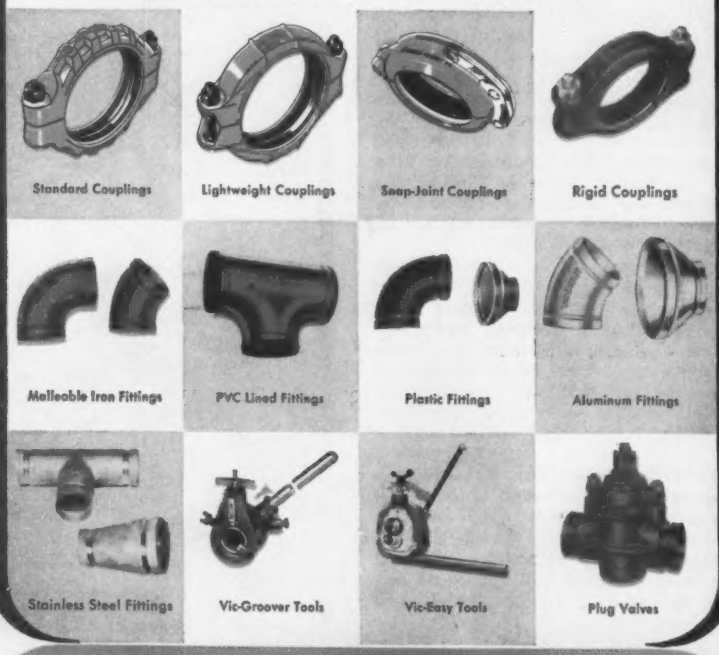

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Idaho *(Continued)*

750-ft tramway at the Plowboy mine north of Priest Lake, officials of Selkirk Mining Co. said. The tramway will be used to transport lead-silver ore from a surface ore showing to a stockpile site located near the dump of an old tunnel at a lower elevation. The firm plans to truck the high grade ore to a smelter and hold the milling grade ore in stockpile for shipment to a concentrator.

Hall Mountain Thorite Co., Spokane, has started construction of a work cabin at mining properties near Porthill and bulldozing has begun to explore for the extension of a thorium bearing vein uncovered previously.

Several Idaho companies interested in development of new uses for silver successfully plugged for installation of a silver water purification system in the municipal swimming pool at Wallace, Idaho. The silver companies hope that cities will use the metal to purify all their water supplies. A major advantage, they claim, is elimination of the chlorine taste and odor in drinking water.

Bunker Hill Co. will manufacture a highly concentrated green acid exclusively for Collier Carbon & Chemical Corp. through a phosphoric acid manufacturing agreement with the Los Angeles firm. Bunker Hill will use a new process and plant design developed by Collier.

Idaho Mining and Milling Co. announced plans to move a dredge into the Florence basin area south of Lewiston by Sept. 1. The firm, headquartered at Lewiston, plans to start gold dredging operations in the basin area this fall.

ILLINOIS

International Minerals & Chemical Corp. reported a 21% gain in earnings on a 10% gain in sales for the fiscal year ending June 30, 1960. Major earnings gains were contributed by the Agricultural Chemicals Div., which produces fertilizer ingredients, according to the firm.

MICHIGAN

Copper Range Co. will start a $2-million program to develop a newly-found copper deposit in the Upper Peninsula of Michigan with the sinking of a shaft in the ore body. Additional mining and metallurgical testing will follow completion of the shaft, scheduled for the fall of 1961. If these tests show the ore and mining conditions to be similar to those of the company's near-by White Pine Mine, Copper Range will establish a mining unit on the site.

MINNESOTA

Reserve Mining Co. has begun an ex-

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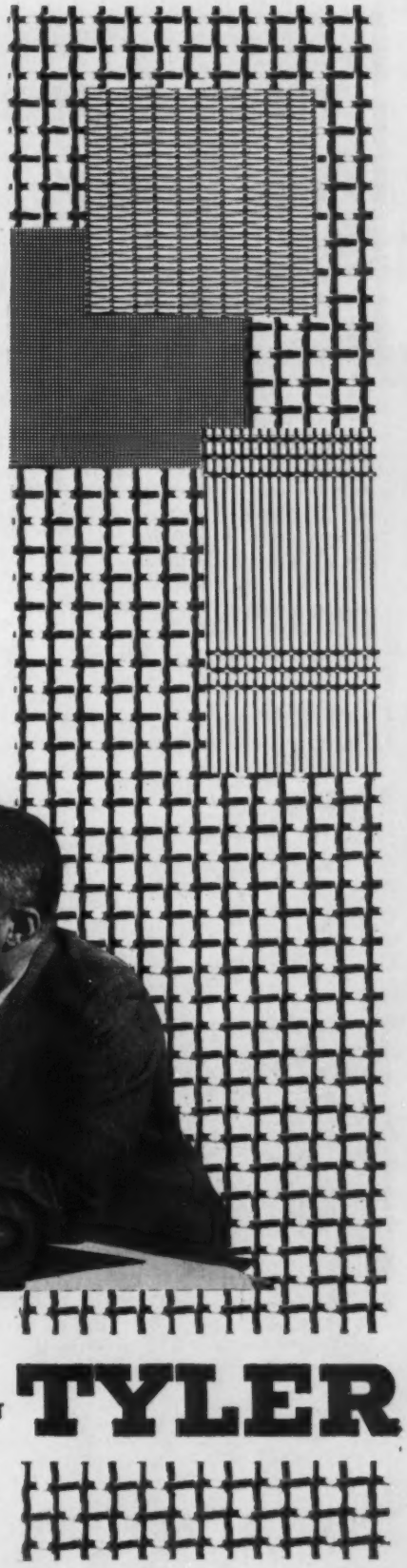

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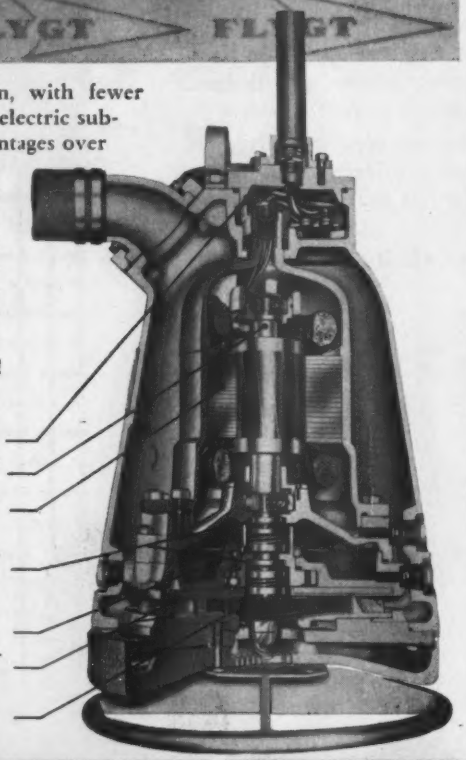

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Minnesota *(Continued)*

pansion program that will involve construction of a second complete primary crushing plant, double tracking the 47-mile railroad from Babbitt to Silver Bay, lengthening the 1350-ft fine grinding and concentration plant to 2150-ft, and construction of additional shop and storage facilities. Plans for financing the $120-million project are incomplete and require stockholder approval.

The M. A. Hanna Co. is testing a "Lectra Haul" (E&MJ, March 1960, p 77) electric wheel truck at its Hunner mine west of Coleraine.

Jones & Laughlin Steel Corp. has begun shipping from its Lind-Greenway property at the west end of the Mesabi range. The two pits of the mine, separated by the Prairie River, are now down to 30 ft below the river bottom.

The Duluth, Mesabi & Iron Range railroad has under construction at Two Harbors an infrared ore thawing unit developed by experiments during the last two winters. Although this method has been employed for other ores, it has not had use for thawing frozen iron ore. The 36-car plant will thaw iron ore frozen in railroad cars in 10-60 min., as compared to two to 15 hr by the old steaming method.

Gov. Orville L. Freeman and W. S. Moore, president of the W. S. Moore Co., announced jointly that the company has a 25-yr lease on the Scranton mine at Hibbing. Moore will begin tests to determine whether the low grade ore remaining in the mine, closed since July 17, can be beneficiated.

Completion of renovation of the entire electrical system at Pickands Mather & Co.'s Sunday Lake mine at Wakefield, was announced by the company recently. One of the most important features included was the installation of automatic pumping on the 27, 29 and 31 levels. A signal system, called "Telescan," keeps the mine engine house informed of the operating conditions of the pump and the depth of water in each of the sumps on the three levels.

MONTANA

Teams of geologists working in northwest Montana for the minerals survey sponsored jointly by Pacific Power & Light Co, the Great Northern Railway, and the Montana Bureau of Mines and Geology expect to complete work this summer in the Yaak River quadrangle and extend surveys into the Ural and Thompson Falls quadrangles of the Troy-Libby area.

During the past two summers, the survey parties from the state bureau's field offices in Kalispell have mapped all of the Thompson Lake quadrangle east of Libby and portions of the Yaak River quadrangle north of Libby. Preliminary reports, with maps, based on field work completed during the first two years of the 5-yr survey program are presently

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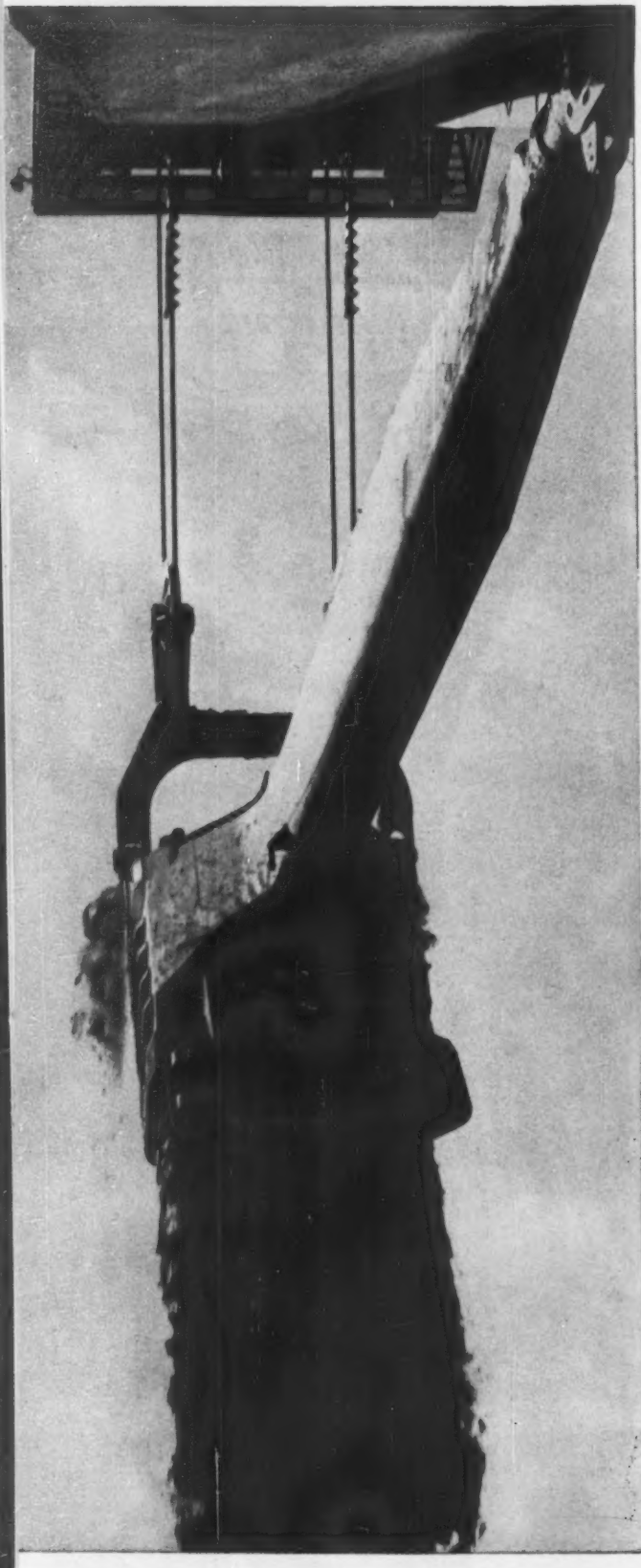
Excavator manufacturers don't *have* to use herringbone gears. Some do. One of them is Marion. It boils down to just how literal a manufacturer is trying to be when he says "our machines have longer life." Marion knows, and so do discerning big-machine owners, that the unique design of herringbone gears does mean longer life in the truest sense. Smoother power flow too, with less vibration. More metal is in constant shear which means the unit is delivering total power at all times. Yes, it takes more machining operations to produce them. Yes, they're more expensive. But dollar for dollar, over the life of a Marion, such significant improvements as herringbone gears give you value received "plus." Just one more example of Marion quality in action for the big mining and quarrying jobs of the Sixties. Marion Power Shovel Company, Marion, Ohio, a Division of Universal Marion Corporation.

MARION

USS "T-1" Steel has



Impact abrasion resistance for long life.
5 times the life has been obtained from shovel bucket teeth and lips made of USS "T-1" Steel. In this case, the entire bucket and handle were built lighter, stronger and more durable because of the qualities of USS "T-1" Steel. Payload is increased and maintenance costs greatly reduced.

Weldability for low-cost field maintenance.
Shovel tooth being welded from USS "T-1" Steel plate. On-the-job maintenance for buckets, truck liners and other parts saves thousands of dollars annually. Buckets can be rebuilt without the use of expensive castings.

This mark tells you a product is made of modern, dependable Steel.

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No other metal combines the qualities found in "T-1" Steel that make it so suitable for rugged mining equipment. It pays for itself many times over in longer life, ability to keep machines on the job. Even at temperatures down to 50 below zero, USS "T-1" Steel retains its toughness. For information on "How to Weld 'T-1' Steel," write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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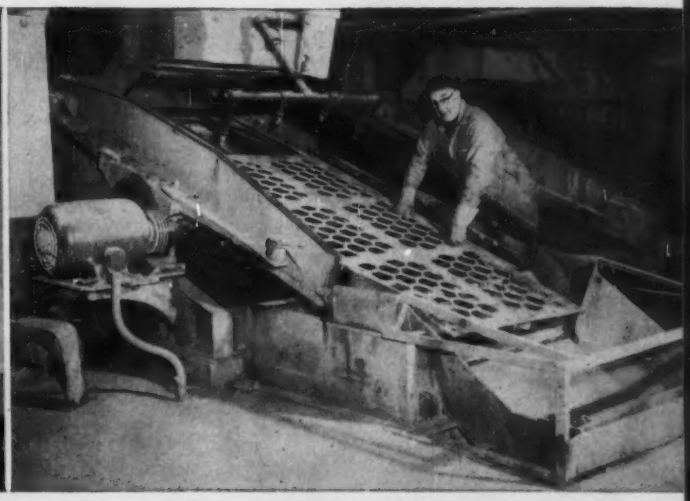
Strength for extra payload.
This is the world's largest dump truck. The body is built entirely of USS "T-1" Steel to haul 165 tons or 110 cubic yards. 12½ tons of weight were saved by utilizing the great strength of USS "T-1" Steel which has a minimum yield strength of 100,000 psi. Increased payloads of 25% are common for trucks and mine cars.



Toughness for reduced maintenance.
Vibrating screens, chutes and bins made of USS "T-1" Steel take the pounding and last many times as long as ordinary steel.

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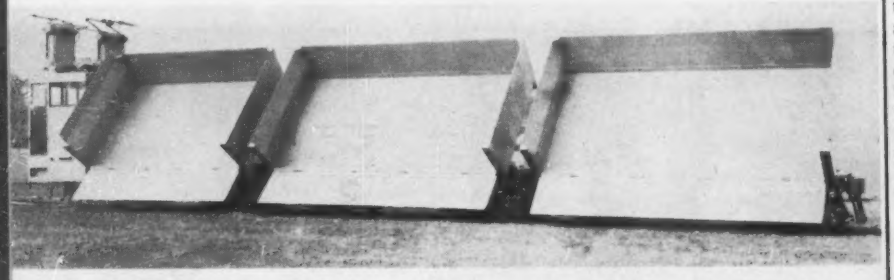

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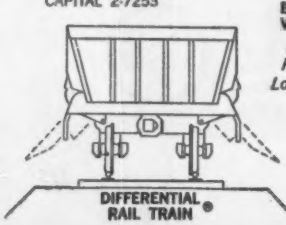

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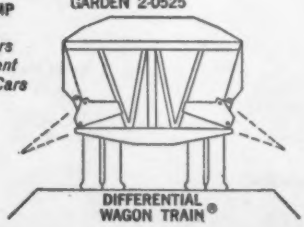


Montana *(Continued)*

available to the public. Ultimately the program expects to map 6,800 sq miles of Lincoln, Flathead and Lake Counties.

Anaconda Co. announced Aug. 1 that it has withdrawn its petition to the Silver Bow County Commissioners for abandonment of the Meaderville Road, and will start preparing company-owned ground east of the roadway for open-pit mining operations.

The company explained that it is necessary to mine and treat low grade ore east of the Meaderville road along with higher grade material to obtain maximum copper recovery. Failure to mine these low grade deposits in the near future would cut short by many years the open-pit mining program in Butte, the company said.

In preparation for the beginning of production operations in Red Lodge, Mont., limestone quarry, the Multi-Mineral Products Corp. held a general inspection and orientation tour for its officers and principal stockholders.

Three separate tours have been made through the company's facilities in the area and near Cody, Wyo., in the last two weeks. The first was a meeting of officers of the company and representatives of two contracting companies who will be engaged in the exploitation of local limestone beds. The limestone deposits to be exploited will be above Red Lodge with a processing plant and offices in the town.

NEVADA

White Caps antimony mine at Manhattan in Nye County is back on regular schedule of operation, according to Fred Vollmer, general manager of the operation. Trouble with timbering was encountered at the 1160 ft. level during June, causing a delay in sinking operations which have been in progress for several months. Objective is to reach and clean up the 1200 ft level in order that drilling can be started to reach an ore body known to exist at the 1300-ft level.

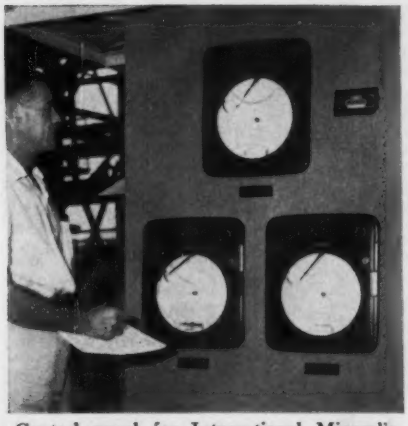
American Exploration & Mining Co. has started the first phase of a sampling project on Consolidated Goldfield ground near Goldfield in Esmeralda County. Hatfield Goudey is the geologist and Don Beauregard is engineer in charge of the operation. American Exploration completed a sampling project in Arizona before moving onto the Goldfield property.

Boyle Bros. of Salt Lake City, are conducting drilling operations in Mason Valley north of Yerington for Kennecott Copper Corp. Work is under direction of the Bear Creek Mining Co., exploration organization of the Kennecott firm. The rig in use is a diamond core drill used in determining orebodies at depth. The program is under way on land included in claims filed several months ago by Theodore A. Dodge for Kennecott.

This 16" Foxboro Magnetic Flow Meter meters phosphate rock slurry as simply as water. Magnetic meters have no flow restrictions of any type — measurement is made magnetically from electrodes flush-mounted in meter wall. In three years of continuous operation the only maintenance on this meter has been a liner replacement.

At International Minerals:

Rock slurry metered directly in dry-tons-per-minute thanks to the Foxboro Magnetic Flow Meter



Control panel for International Mineral's Mass Flow System has 3 Foxboro Dynalog* Recorders. Bottom two record pipeline flow and solution density. Product of the two is then recorded on upper Dynalog *directly* in dry-tons-per-minute. *Reg. U.S. Pat. Off.

At The International Minerals & Chemical Corp., Bartow, Florida, phosphate rock slurry is pipelined from the mining operation to the flotation plant 5 miles away. Problem was, how to let mine head operators know how much rock to feed into the pipeline to maintain constant flow.

A mass flow system — based on the Foxboro Magnetic Meter — proved the perfect answer. In this unique system, the Magnetic Meter measures flow in gpm, while a gamma ray cell measures solution density. The product of the two values is then recorded *directly* in dry-tons-per-minute.

Mass flow — pressure — temperature — pH — no matter what your measurement problem, there's a combination of Foxboro instruments to solve it. And there's an industry-trained Foxboro field engineer nearby to help show the way. Call him — or write Foxboro about your problem direct. The Foxboro Company, 199 Norfolk Street, Foxboro, Massachusetts.

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Sturtevant Construction Assures Long Mill Life at Top Loads

Sturtevant crushing and grinding machinery answers the long life top-load production problem for medium to small size plants. Many Sturtevants have been operating above rated capacities for more than 25 years, and *without a major repair.*

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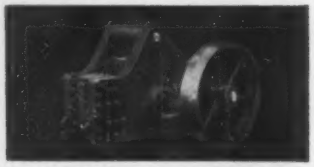
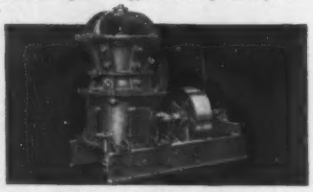
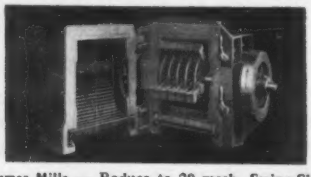


Jaw Crushers — Produce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*

Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

STURTEVANT MILL COMPANY
101 Clayton St., Boston 22, Mass.

Nevada *(Continued)*

The Sheba Mine in the Humboldt range of Pershing County is again active, according to Dr. Joe Beasley Jr., owner and operator of the property. During the last several months 2600 ft of tunnels have been cleared and put into usable condition, and seven men are now employed at the site. In cleaning the tunnels Dr. Beasley reports that an overlooked vein was discovered with sufficient gold content to warrant operation. Flour gold, not recoverable in former operations, is also said to be present in the Sheba dumps.

Charles E. Fancher and Jake Baird have filed on a large deposit of diatomaceous earth west of Lovelock near the pits now being mined by Eagle-Picher Co. and Great Lakes Carbon Corp. Dicalite Div., New York City, has shown an interest in leasing the property which lies in Pershing County. Fancher and Baird were discoverers of the diatomaceous earth deposits which resulted in Eagle-Picher's present mining operations in the area.

Mervin Gallagher, Nevada Mines Inspector, predicts that recent passage of a bill to stabilize lead and zinc mining in the U.S. will mean resumption of work in mines in Lincoln, Eureka and White Pine Counties. Numerous mines in that area have been active during the last seven years, which will permit them to be eligible for Federal payments under the act.

Ruby Hill Mining Co., which now owns all the properties formerly controlled by Eureka Corp. Ltd., has started drilling operations in the Eureka Mining District of Eureka County in an endeavor to determine the extent of ore deposits with lead-zinc-silver-gold values previously revealed by drilling conducted by the Eureka Corp.

W. H. Wathen, Camino, Calif., and Archie Branch, Bakersfield, Calif., have uncovered a gold vein in Limerick Canyon 25 miles southeast of Lovelock. After several summers of work with heavy equipment, the two men put in a cut 120 ft long in which they found gold stringers. This cut turned into a 50-ft tunnel where a flat vein was found. At last report the vein was 18 in. wide and showing good values.

OHIO

Cleveland-Cliffs Iron Co. announced earnings of $5,097,427, for the first six months of 1960, compared with $4,739,504 for the same period in 1959, in its Interim Report to Shareholders. Earnings per share of common, after preferred dividend requirements, amounted to $1.89 for the first half of 1960, compared with $1.71 for the first half of 1959.

Covered in the report were the recently announced 900,000-tpy expansion of high grade pellet production from low grade iron ore at the Republic Mine, Republic, Mich., and the completion of a 325,000-ton expansion of iron ore concentrates at the Humboldt Mine, giving an estimated capacity of 650,000 tons of pellets from the Humboldt, Mich., property. Cleveland-Cliffs expect sa total production of high-grade iron ore pellets of 2.25-million tons by early 1962.

NEW MEXICO

American Metal Climax Inc. will spend nearly $3-million for expansion of the Southwest Potash Corp. facilities in Carlsbad, Frank Coolbaugh, Amax president, announced.

This expansion is the second taken by Southwest since its mine and mill were brought into production late in 1952. The last increase in capacity was made in 1955.

OREGON

Work is continuing on the lower adit at the Buffalo gold mine in the Granite District of Grant County. The level is 250 ft below previous workings and is being driven to tap the orebody which has supplied shipping and milling ore for many years.

Robert Hulin, who discovered cinnabar early in 1959 on Cave Creek, a tributary of Burnt River, Baker County, has

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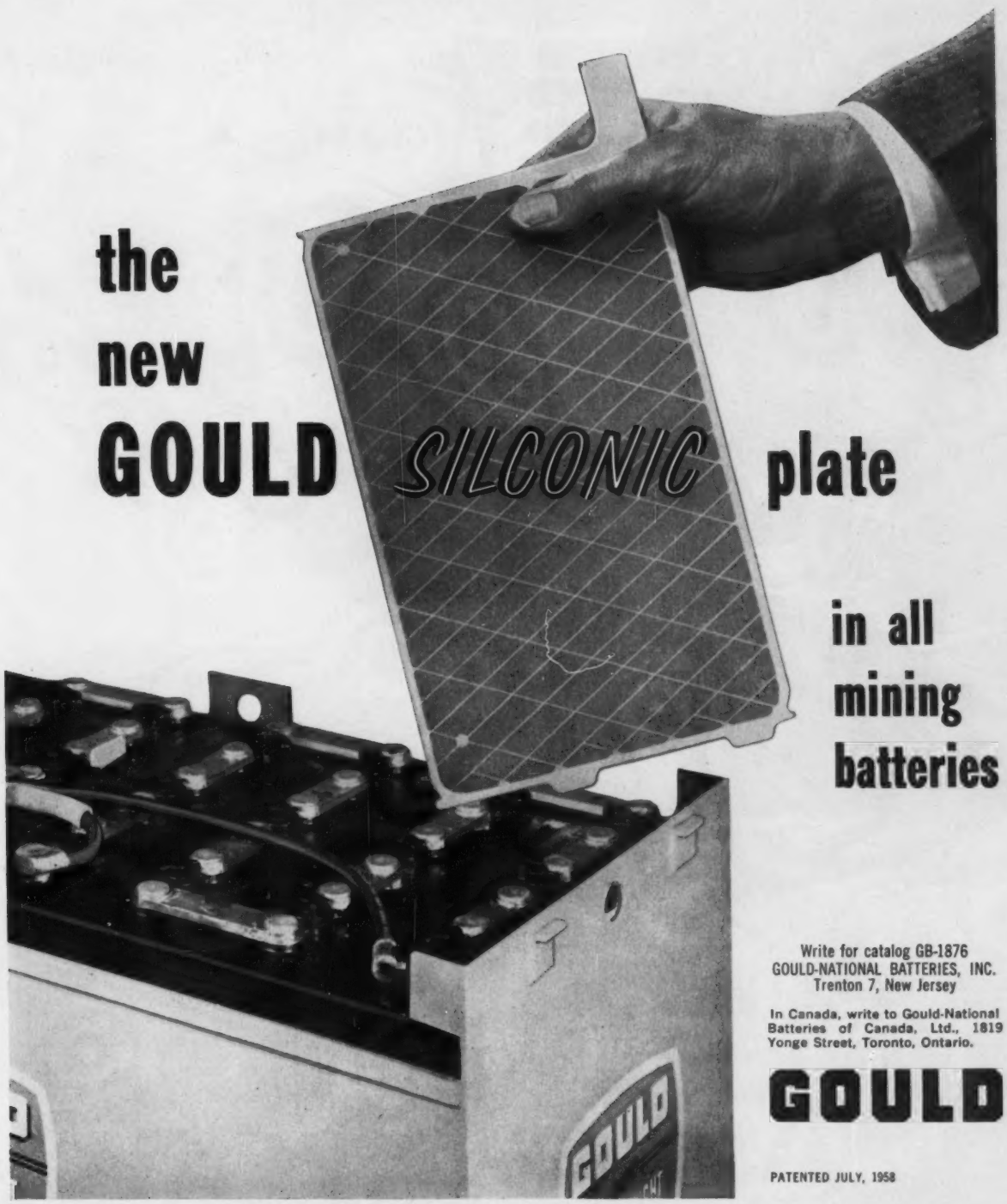

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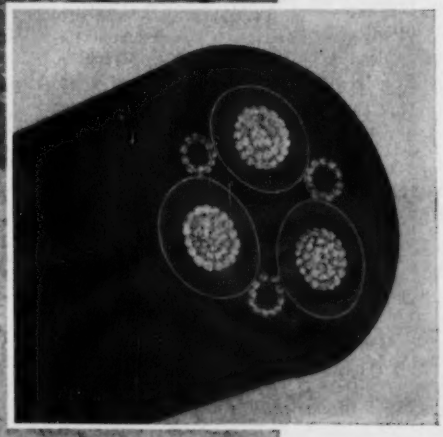

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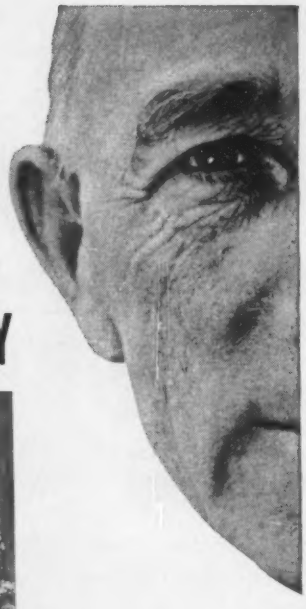

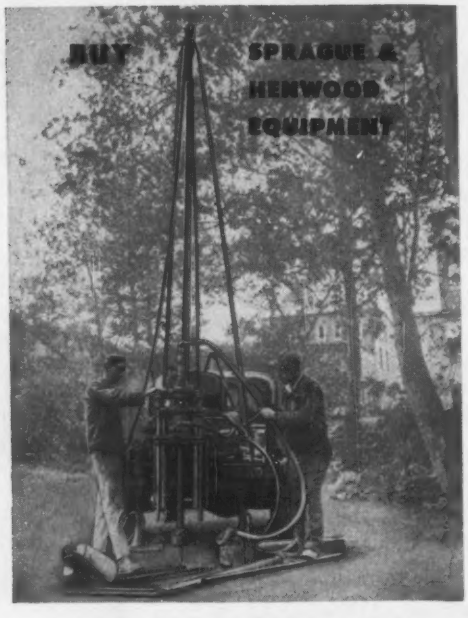

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Oregon *(Continued)*

continued prospecting and now has cinnabar showings on 9 out of 10 claims distributed along a fault zone in Burnt River schists.

TENNESSEE

American Zinc Co. of Tennessee stopped production at their Grasselli zinc mine on Aug. 12. The mine, located at New Market, Jefferson County, was producing approximately 350 tpd of lead-free zinc ore from the Knox dolomite. American has four other active zinc mines in the East Tennessee zinc district, which extends from Mascot to Jefferson City.

Results of studies on various reducing carbons for electric phosphorus furnace operations are carried in TVA's latest Chemical Engineering Bulletin No. 4. As a result of the tests, TVA has adopted the use of bituminous coal to supply approximately half of its requirement for reducing carbons. Use of this coal in combination with coke will save about $175,000 a year.

TEXAS

International Minerals & Chemical Corp. is constructing a $500,000 barite processing plant in Houston, Tex. The highly automated plant, which will employ about 15 persons, will begin operation by mid-November, according to Charles Loucks, general production manager, Industrial Minerals Div. Barite ore will be acquired domestically from Missouri and imported from Mexico, Peru and the Mediterranean area.

UTAH

Development department of Kennecott Copper Corp. has taken over the Tintic Unit, Tintic mining district, from Bear Creek Mining Co., KCC's domestic exploration firm.

At the same time, it was announced that Centennial Development Co., Eureka mine contractors, had commenced driving of a 440-ft incline winze for Kennecott in the lead-silver-zinc ore discovery area at the unit.

"This marks transition of the project from exploration to development stage," said a spokesman for Bear Creek.

WASHINGTON

The state of Washington has provided $5000 in state funds to assist a mineral survey being conducted by the Pend Oreille County Public Utility District. The field study was started recently by the division of industrial research of Washington State University.

Northwest Magnesite Co. sharply cut back operations at its Chewelah plant

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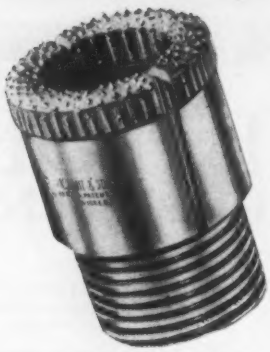

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Washington *(Continued)*

during the last week of June. About 175 men were laid off. The firm said that a small crew will continue sizing and finishing of milled concentrate at the reduction plant while operations at the company's quarry were virtually at a standstill. The curtailment of operations will last about 30 days, officials said.

Daybreak Uranium Inc., Spokane, reported a new drilling program on the Dahl lease in the Mt. Spokane mining district. An orebody 100 ft long, 35-ft wide and 5-ft thick has been indicated by the drilling so far. The autunite ore was at a depth of 35 ft and a bulldozer is stripping the area for mining.

At the same time the firm reported it has dropped two other leases in the Mt. Spokane area, the Lowley and Huffman leases, because the uranium ore was found unprofitable to mine. The company announced a 150-tpd mill will be operating at the old Silver Hill mining property five miles south of Spokane. The mill is expected to be in operation by September.

Production of tungsten and tin concentrates from the Silver Hill mine five miles south of Spokane will be purchased by the Wah Chang Corp., according to Carl A. Coon, who heads a group of Spokane men operating the property.

Wah Chang has offered to buy all production on a long term basis, Coon said. The tungsten concentrates would be shipped to the firm's processing plant at Glen Cove, N.Y., and the tin concentrates would go to Texas City, Tex.

Ore stripping and stockpiling operations are underway at the Silver Hill property and the group expects to move in milling equipment later this year. They plan to set up a 50-ton gravity type concentrator.

Gov. Albert D. Rosellini disclosed that field work on a survey of the state's limestone deposits will be completed this fall. A complete report on the survey may not be ready for publication until early next year, however.

WISCONSIN

Higher water levels of the Great Lakes and connecting channels have enabled the big lake carriers this season to move the largest cargoes in six years, including a new ore carrying record by Inland Steel Co.'s Edward L. Ryerson of 23,378 tons.

Water levels in Lakes Huron and Michigan this year were about 2 ft higher than a year ago, up to nearly 581 ft above sea level. The down channel draft of the St. Marys River, connecting Lakes Superior and Huron, rose nearly 13 in., and that in the Detroit River 26 in., over that of last year. Last winter's big snows and months of above normal rainfall caused this year's rise.

The New Jersey Zinc Co. has started

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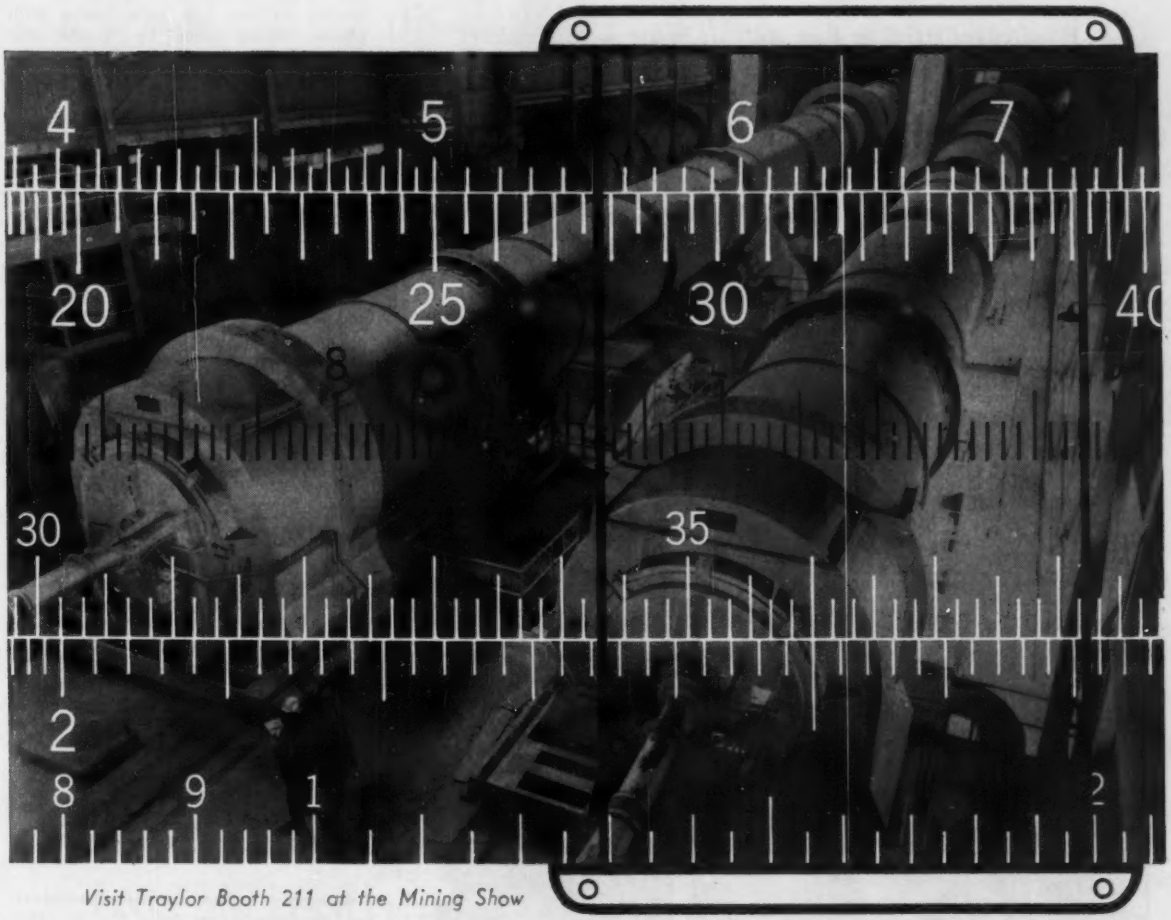
from design through installation to operation



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*Shown in the background are two additional Traylor Kilns, 11′-3″ x 270′.

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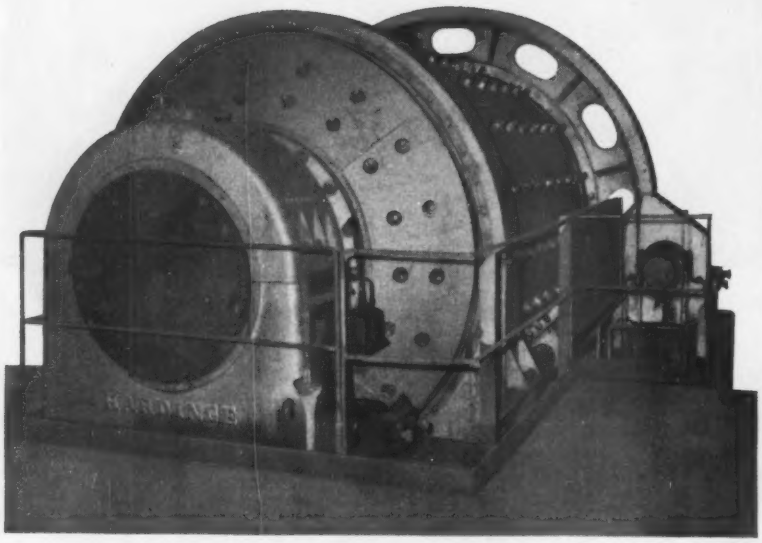

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Wisconsin *(Continued)*

sinking an incline for the development of a zinc mine near Elmo, seven miles southeast of Platteville. Construction of a flotation mill designed to process 600 tpd of ore is scheduled for 1961. The firm has purchased the land needed for the operation.

New Jersey Zinc had been prospecting on leased land in southwestern Wisconsin for the last eight years, with churn drilling done by Moore and Siegal, Shullsburg. The contract for development work at the new mine was awarded to the Ivey Construction Co.

WYOMING

The recently announced Green River soda ash mine and plant of Stauffer Chemical Co. will cost an estimated $15-million, Stauffer officials reported. The firm selected a site for the plant and mine east of the Green River in order to avoid possible conflicts with the Seedskadee reclamation program west of that river.

Operations at the plant and mine are scheduled to start in 1962 and will employ an initial 150 persons. Stauffer said that its grade of crystal soda ash at Green River will be "as high or higher" than any produced in the nation.

Robert W. Adams, president of Western Nuclear Corp., has obtained an option to acquire 8,380 acres of mica claims in the South Pass area, 25 miles southwest of Lander. The claims extend 22 miles along the foothills of the Wind River mountains. Adams is conducting studies on the mining and marketing potential of the deposits.

IN CANADA

ALBERTA

Two separate in situ recovery experiments on bituminous sands lease No. 13 (49,872 acres) have been proposed by Shell Oil Co. of Canada Ltd. in a recent application to the Alberta Conservation Board.

The purpose of the first experiment is to initiate combustion within the tar sand body by preheating the sand with steam prior to ignition. Following ignition of the tar sand, propagating the combustion zone by control of the air injection rate will be investigated. Five holes are required for this experiment: one injection well, two production wells, one temperature observation hole and one sampling hole.

The object of the second experiment will be to heat the tar sand body by prolonged steam injection and to evaluate the productivity of the tar sand at elevated temperatures with a steam or hot water drive. This calls for a group of 15 holes: six temperature observation wells and the rest injection, production and condensate withdrawal wells.

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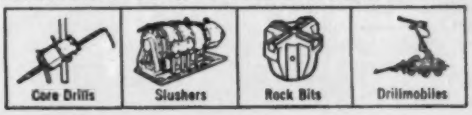

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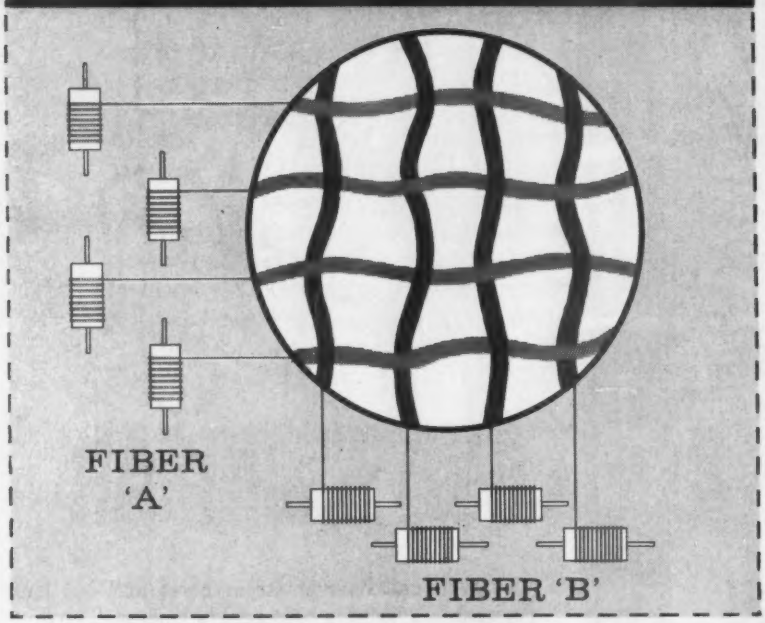

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BRITISH COLUMBIA

Cowichan Copper Co. Ltd. expects to start active development work before the end of this year on its Avallin and Caycuse copper properties on Vancouver Island. Work during the last year has been confined to prospecting and keeping the claims in good standing, O.G. MacDonald, president, reported.

Silver Standard Mines Ltd. has turned down a contract offer for iron concentrates by the Japanese firm of Sumitomo Shoji Kaisha Ltd. at a price considered too low. An option held by Sumitomo expired June 30 but negotiations are continuing. Silver Standard is asking the standard world price of $9.70 per ton for 62% concentrates trimmed and loaded at Harriet Harbour, Vancouver Island.

Diamond drilling results indicate an increase of possibly double in ore reserves averaging 51.9% iron. Last reported ore reserves were 2,626,000 long tons. About 1-million tons of 62% concentrates could be mined by open pit taking three to four years to produce, H. B. Gilleland, mine manager, estimated. A 2,000-ft tunnel would then be needed.

United Keno Hill reports production in quarter ended June 30, was 1,853,400 oz silver, 5,604,900 lb lead and 3,980,800 lb zinc. This compares with 1,799,100 oz silver, 5,504,200 lb lead and 3,662,200 lb zinc in the previous quarter.

Bralorne Pioneer Mines Ltd. has suspended ore production at the Pioneer division although drift development and diamond drilling of the new 32 vein and other structures will continue.

Suspension of mining was dictated by the sub-marginal grade of the remaining Pioneer reserves, Franc R. Roubin, president, said. The mines will be more productive at the Bralorne division and it is expected present earnings will be maintained, he explained.

Drill exploration on the Bralorne Pioneer Ace Option project has revealed a vein structure with important gold values over minable width to an apparent length of more than 750 ft.

A promising vein has been intersected at the Bralorne 20 level and further exploration is being made, Roubin reports.

Jericho Mines Ltd. reports diamond drilling will start immediately on its copper property in Highland Valley following a recommendation by Fred J. Hemsworth, mining engineer. Three holes will be drilled at 45°. Mineralization was revealed by road construction at the 4,200-ft elevation.

Anglo Turkish Development Co. Ltd. has acquired under option some 400 claims in the Greenwood area and, in air-borne geophysical surveys, has located 19 major anomalies. Dr. Christopher Riley, consulting geologist, is directing development.

Phoenix Copper Co., plans to mill stockpiled ore on the dump at the Stemwinder mine shaft near Phoenix. The work will be done under an agreement with Continental Consolidated Mines,

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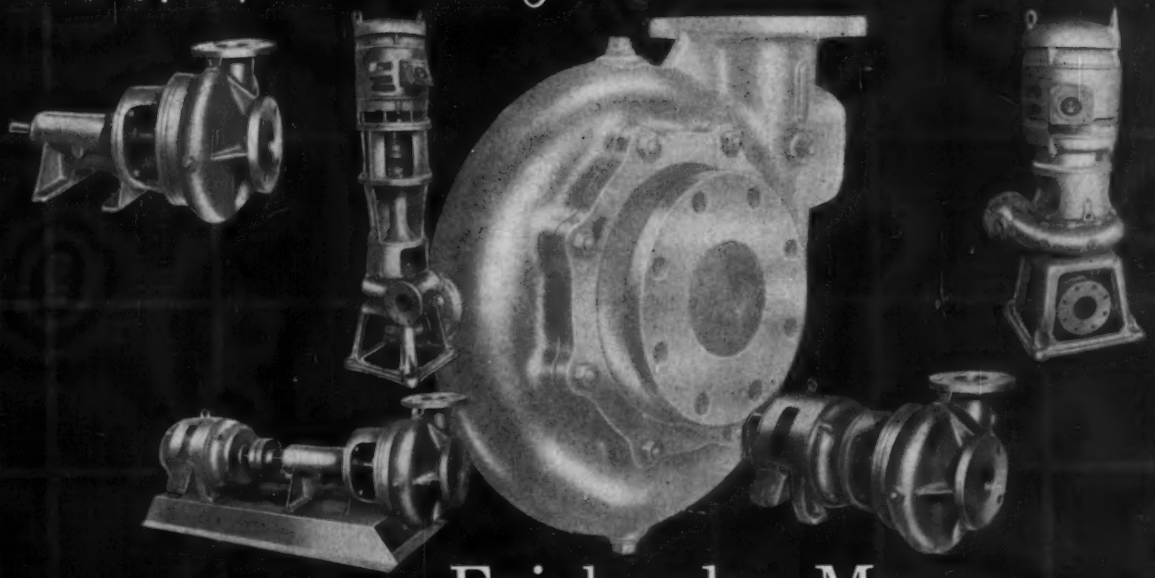

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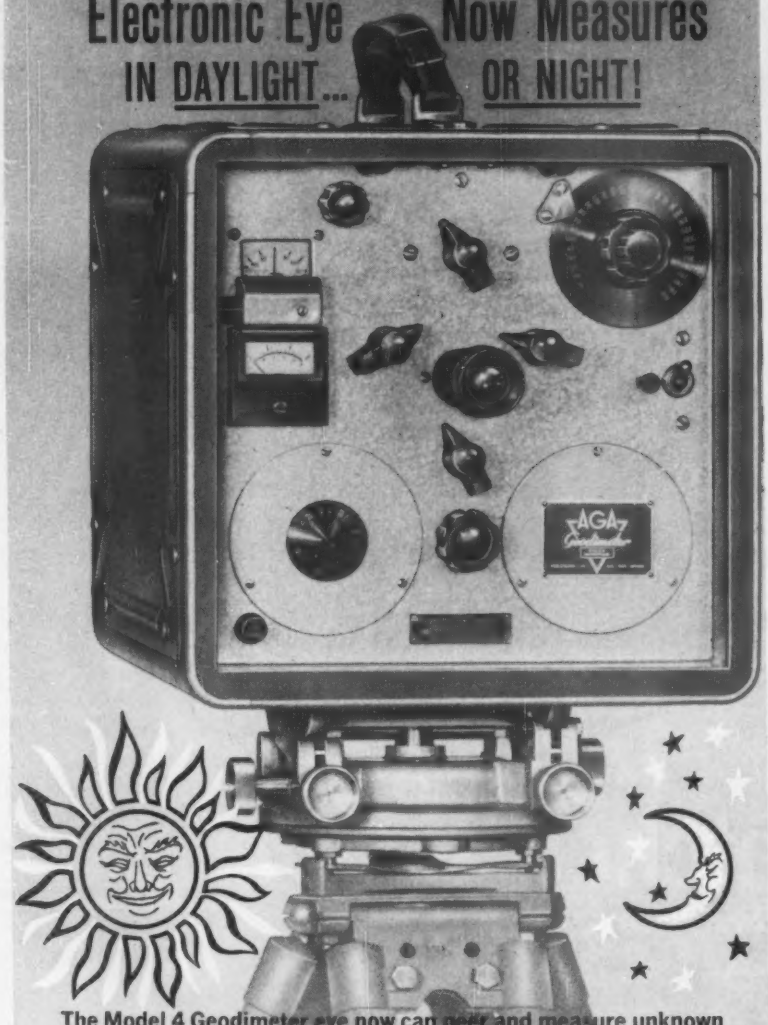

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B. C. *(Continued)*

which will do drilling work to determine the feasibility of open-pit operations. Phoenix is a subsidiary of Granby Mining Co. Ltd.

Exploration work on the molybdenite discovery made last fall at Hastings Arms by Consolidated Standard Mines is under way. John S. Scott, mining engineer, reports "an impressive quantity of good grade quartz float seen in the canyon as well as fragments of fractured and mineralized dyke. An area 50 by 100 ft may carry 0.5 to 1.0% molybdenite." Present work consists of trenching and sampling. Exploration activities of Consolidated Standard are under the general direction of Bralorne Pioneer Mines Ltd., principal shareholder.

Consolidated Mining & Smelting Co. made an estimated profit of $13.29-million in the first half of the year, a boost of more than $4.7-million in the corresponding period last year. Bluebell mine at Riondel rated as the highest grade of the company's three base metal operations, according to figures released by the B. C. Department of Mines. Its recovery averaged 4.2% lead, 6% zinc and 1.2 oz silver per ton. The Sullivan mine had a recovery of 4.1% lead, 5% zinc and 1.4 oz silver; and the H. B. mine 0.78% lead and 4.5% zinc.

Giant Nickel Mines Ltd. Shipped 1,-698.76 tons of nickel-copper concentrates to Japan in July. The company expected to ship 3,500 tons in August and 2,000 tons monthly thereafter. Mill recoveries in the January-April period averaged 76.7% nickel and 92.3% copper. Metallurgical changes improved nickel recovery by 0.7% during the period.

ONTARIO

Despite some slackness in the steel industry, Steep Rock Iron Mines is expected to make a fairly good showing this year. Sales are expected to come up to at least 2-million tons of iron ore from the Steep Rock Lake operations. In addition, the company is receiving additional income in royalty payments from Caland, which started production early in May. In outside work the company is taking a look at its promising magnetite property in the Lake St. Joseph area. Word is that a construction decision for this property could come next year.

Production operations have started at the Red Lake area gold mine of H. G. Young Mines. Ore is being trucked some 16 miles to the recently acquired Starratt mill. At the proposed 225-tpd rate, the mine is estimated to have a 3-yr ore supply. Reserves to the 934-ft level are calculated at 270,000 tons averaging 0.31 oz gold cut or 0.41 oz uncut. The shaft goes to depth of 1,052 ft with six levels established. Only three levels, the 509, 634 and 934, have been developed as yet.

(Continued on p 199)

An Invitation

TO PROFIT-MINDED MAINTENANCE MEN

If . . . you are really concerned about equipment wear and replacement costs, and you want more efficient maintenance, faster repairs and longer service life . . .

Then . . . BOOTH 800 at the AMC Metal Mining Show, Las Vegas, October 10–13, should be a MUST on your schedule of things to see because here you will find . . .

WEAR-O-MATIC

HARD SURFACING PROCESS

Wear-O-Matic, the newest, fastest growing process for semi-automatic application of build-up and hard surfacing alloys, outperforms standard application methods in every respect. Wear-O-Matic utilizes straightening rolls and positive feed drive rolls to provide an uninterrupted supply of wire to the welding tip from the 100 pound WELD-PAK wire package. WELD-PAKS, revolutionary method for packaging wire, are easier to handle, easier to store and require less time for set-up or change than any packaging method previously devised. A snap of the lid seals unused wire against dust, dirt and weather. The Wear-O-Matic process is the most significant advance in the application of wear resistant alloys in recent years, offering greater economy, efficiency and higher quality deposits.

Take advantage of this opportunity to compare the Wear-O-Matic hard surfacing process with other methods and alloys. See how easily and inexpensively Wear-O-Matic will revitalize your maintenance program.

If you will not be attending the Mining Show, write for descriptive Wear-O-Matic literature to Alloy Rods Co., P. O. Box 1828, York 49, Pa.

ALLOY RODS COMPANY

YORK, PENNSYLVANIA

SALES OFFICES & WAREHOUSES; BOSTON, NEWARK, PHILADELPHIA, PITTSBURGH, BIRMINGHAM, CHICAGO, SAN FRANCISCO & EL SEGUNDO, CALIF.—DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

these economies and other savings can expand the market for beryllium oxide substantially, it is expected that the position of beryllium metal will also be improved because beryllium oxide must be produced as an intermediary step in the production of the metal.

Growth of the Industry

Progress in the beryllium industry can be judged in part by the growth of the two companies which process beryl into beryllium metal products:

Brush Beryllium Co. sales have increased from $2.1-million in 1954 to $18.1-million in 1959. Brush produces beryllium metal, beryllium-copper, beryllium-aluminum, beryllium-nickel, beryllium oxide and other compounds. In 1957 it opened up a $4.5-million plant at Elmore, Ohio, designed to produce 20,000 lb of beryllium as hydroxide, and 10,000 lb per month as vacuum-cast beryllium metal. Brush plants include rolling, foundry and fabricating facilities.

Beryllium Corp. sales have gone from $7.4-million in 1954 to $21.2-million in 1959. The company produces beryllium metal, beryllium-copper alloys, beryllium-aluminum, beryllium-iron, and beryllium compounds at Reading, Pa., and beryllium metal and compounds at Hazleton, Pa. The company has rolling, foundry and fabricating facilities.

Speaking before the Colorado Mining Assn. in 1960, D. H. Hershberger, treasurer of Brush Beryllium Co., said, "Expert mining and milling engineers might be called upon to develop production of a concentrate which can be sold at a suitable price. A $6-million market for beryllium ore can be tapped if the price is right."

Beryllium Ore Prices

Nearly all beryllium to date has been derived from hand-cobbed beryl ores running 10-12% BeO. Commercial beryl ore is quoted in terms of short ton units (stu) of contained BeO. (One stu unit equals 1% of 2,000 or 20 lb of BeO.) E&MJ METAL & MINERAL MARKETS quotes domestically mined beryl at $46-48 per stu depending on quantity. Thus a 10% ore would bring about $460-480 per ton. The higher price on domestic ores is related to General Service Administration's limited buying program, outlined in Table 13. Imported beryl is now quoted at $31.75-32.50 per stu for ores running 10-12% BeO for spot sales; and $34-34.50 for term contracts. Table 16 lists possible buyers of beryl, including importers, dealers and companies buying the mineral directly for processing.

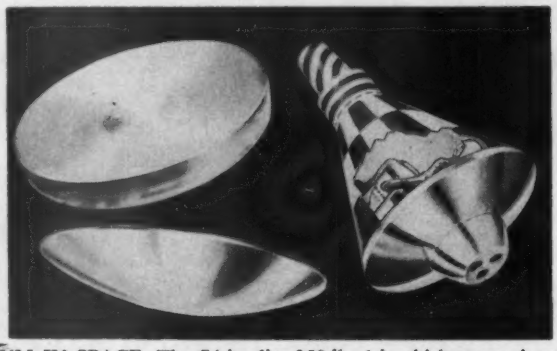
Table 12. Beryllium—Best Heat-Sink Material

	Specific heat	Melting point	Density
Beryllium	0.46	2345° F	1.85 g/cc
Aluminum	0.22	1220° F	2.70 g/cc
Steel	0.12	2800° F	8.0 g/cc
Copper	0.09	1980° F	8.9 g/cc

Pounds of Metal Required for Equal Heat Absorption

Beryllium	350	Steel	1350
Aluminum	700	Copper	1750

Source: Brush Beryllium Co. booklet, BERYLLIUM IN PROJECT MERCURY.



BERYLLIUM IN SPACE. The 74-in.-dia, 350-lb, 1-in.-thick manned space capsule for Project Mercury has been produced by Brush Beryllium Co. metallurgists out of a 58-in.-dia, 8-in. thick billet of QMV beryllium. The billet was machined to 54x6-in., encased in a steel jacket, and squeezed in a 50,000-ton press to produce an 80-in.-dia forging, which was machined to final dimensions. Shown above, not to scale, are the billet, the disk, and the manned space capsule to be used in Project Mercury. Table above shows why low density, combined with a high melting point, placed beryllium in a premium position.

Increasing demand for beryl in the U.S. has pushed the price up from $3 per stu BeO in 11% ores in 1940 to the levels cited above. Conversely, the price of beryllium metal has dropped substantially during the same period, from $100-150 per lb in the late 1940s to the current price of $97.50 per lb for 97% metal in lump or beads. Beryllium-copper master alloy sells for $43 per lb of contained beryllium plus the market price for copper.

Government Objectives

The over-all aim of various Government agencies has been to cooperate with industry in the development of new domestic beryllium resources. Because of the vital functions of beryllium metal and beryllia in reactors, beryl was classified as an atomic mineral. Cooperative work between the U.S. Atomic Energy Commission, Geological Survey and Bureau of Mines produced exhaustive studies of the occurrences of beryllium resources and investigations of methods to extract beryllium from ores. AEC also placed orders with Beryllium Corp., and Brush Beryllium Co. each to produce 95 tons of beryllium metal over a five-year period starting Jan. 1, 1958. However after 6 months these orders were cut back substantially.

Office of Minerals Exploration has recently revised its specifications to include certain minerals other than beryl in the eligible list for exploration assistance. This may have been in response to the possibility that non-pegmatite ores from the Topaz Mt. area of Utah may prove commercial. Since the inception of the OME program in 1951, applications for beryl and beryl-mica exploration assistance numbered 100, of which 21 became contracts having a total value of $228,000 with Government participation of $203,000. Eight of these were certified as discoveries or developments. Table 15 lists the regional offices of OME.

General Services Administration purchases domestically produced beryl under a program which has been in effect since 1952. This program expires June 30, 1962, or earlier if the stockpile shall total 4,500 short tons of beryl. See Table 13 for buying depots and general specifications of the GSA program.

Vitro Minerals Corp. announces that it has executed an exploration loan agreement with the Office of Minerals Exploration of the U. S. Department of the Interior for con-

(Continued on p. 194)

Under day-in, day-out pounding, Mack quality construction pays off by keeping downtime and maintenance at a minimum . . . not just when new, but after years of the toughest service.

Payloads jumped 54% when these Macks took over

New standards of truck efficiency have been set since LRX Model Macks took over the hauling jobs at Limestone Products Corporation of America, Newton, N. J. Production records show that since the new 15-tonners have been in action, daily loading figures have been boosted 250 tons per truck, and there has been a significant reduction in equipment downtime, maintenance and fuel consumption.

Says Limestone Products' president Harry C. Bixler, "Our experience with Macks goes back 30 years, and, as you know, we've always been more than pleased with their performance. You don't have to ask me what kind of trucks we'll buy in the future."

Outstanding performance characteristics enable Macks to contribute to successful quarry and mining operations throughout the world. Mack-built heavy-duty transmissions, with ideally-spaced ratios, give drivers smooth, effortless control through all speeds. Mack Planidrive rear axles provide final ratios capable of handling the heaviest loads without sacrifice of road clearance. Easy, positive power steering gives fast, safe maneuverability at shovel and crusher.

Put Macks to work in your operation, and discover how they'll pay off where it counts most—in your net profit figures. Have your Mack branch or distributor explain in detail which model will fit your job requirements most profitably. Mack Trucks, Inc., Plainfield, New Jersey. Mack Trucks of Canada, Ltd., Toronto, Ontario.

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Pit climb-outs at the New Jersey works of Limestone Products Corporation are made up a 16 degree incline. Whether going up or coming down, engines, brakes and transmissions are more than a match for the toughest grades.

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See the big General Mills extravaganza at Booth 137 of the Mining Show. It's a big three ring show that you'll find interesting, educational, new and profitable.

RING NO. 1—A continuous liquid ion exchange (LIX) demonstration unit shows the latest techniques in the LIX recovery of vanadium employing a recently developed LIX reagent for alkaline and acidic media—General Mills Aliquat® 336.

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Literature, samples and General Mills technical representatives will be on hand at all three "rings."

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CREATIVE CHEMISTRY FROM GENERAL MILLS SERVES INDUSTRY WORLD WIDE

General Mills CHEMICALS

CHEMICAL DIVISION SPECIAL COMMODITIES DIVISION

ducting exploratory work on its new beryllium property in the Topaz Mt. area in Juab County, Utah.

This loan is the first one made by OME under recent changes in regulations, which made exploration for beryllium minerals other than beryl eligible for Government assistance. Vitro Minerals' deposit appears to contain a new type of beryllium mineral which Vitro geologists have named "Vitroite."

Materials Advisory Board has made exhaustive investigations of beryllium resources, extractive methods and applications of the metal in airplanes, spacecraft and other military equipment. Recommendations made as a result of these studies will undoubtedly serve as valuable guides to speed the use of beryllium and its alloys in military and civilian applications.

Toxicity of Beryllium

Some materials containing beryllium are toxic, but no ill effects have been found in mining, sorting or transporting beryl to markets. However, companies now engaged in beryllium exploration programs are maintaining strict dust control in sample-bucking rooms and laboratories to be well on the safe side. A disease, called berylliosis, is caused by certain compounds, dusts, fumes, etc., containing beryllium; which requires safety precautions in plants handling these materials.

Two types of chronic disease may be caused by beryllium dusts or compounds—skin and respiratory. In each, a type of tumor is formed that affects the skin or lungs. The respiratory type may be either acute or chronic. This health hazard did not become apparent until World War II when beryllium and its compounds came into demand.

Since then intensive study has provided industry with effective methods to prevent berylliosis. Working places are kept clean; workers are required to wash their hands frequently, and clothing is laundered regularly.

Table 13. General Services Administration Beryl-Ore Purchase Depots

Franklin, N. H., under jurisdiction of Regional Director, GSA, 620 Post Office and Courthouse, Boston 9, Mass.

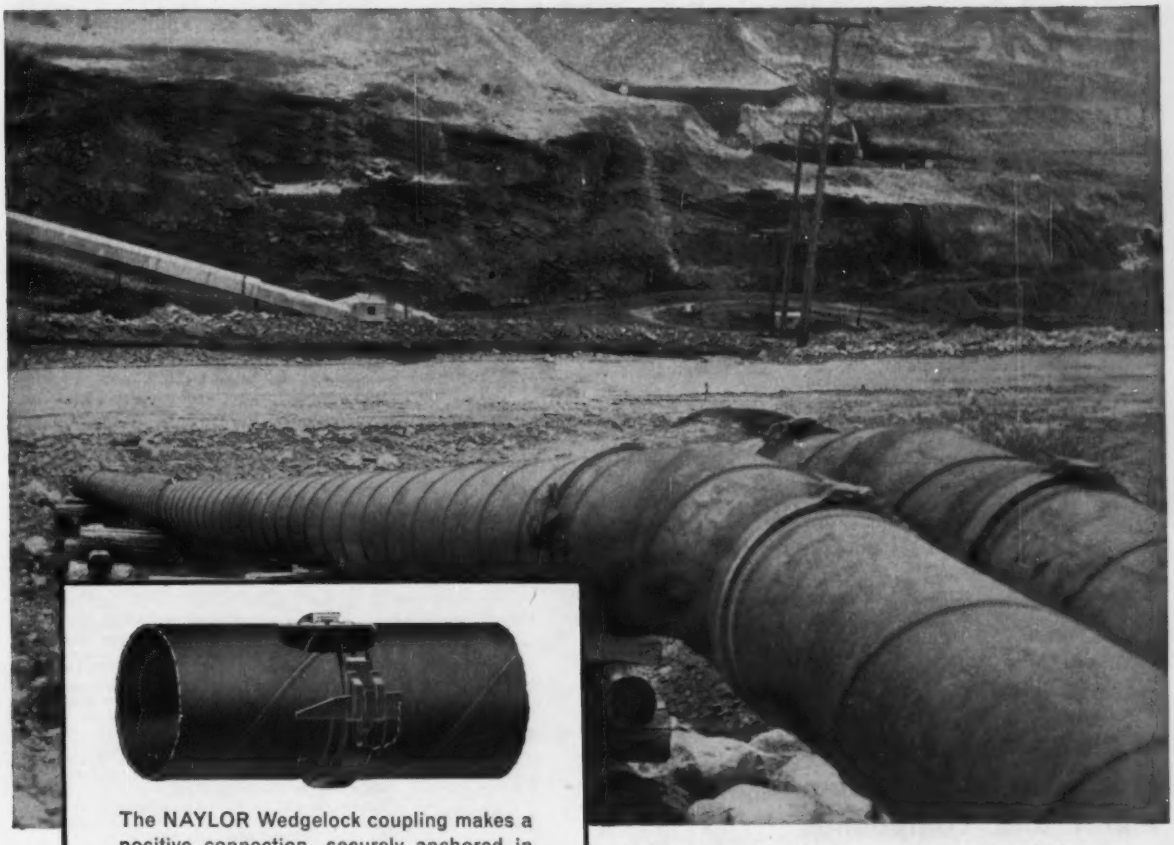
Spruce Pine, N. C., under jurisdiction of Regional Director, GSA, 50 Whitehall St. SW, Atlanta 3, Ga.

Custer, S. D., under jurisdiction of Regional Director, GSA, 1800 Federal Office Bldg., 911 Walnut St., Kansas City 6, Mo.

(Continued on p 196)

KEEP MINING ON THE MOVE

With This NAYLOR *Combination*



The NAYLOR Wedgelock coupling makes a positive connection, securely anchored in standard weight grooved ends.

Mining engineers looking for ways to save time, work and money will go for the performance of NAYLOR Spiralweld pipe and NAYLOR Wedgelock couplings.

NAYLOR pipe is light in weight, so it's easier to handle and install—whether you suspend it, support it, string it along the surface, or bury it. The distinctive lockseamed-spiralwelded structure gives you pipe that is extra strong and safe in service.

The NAYLOR Wedgelock coupling helps, too, because it is designed for faster, easier and more economical connections. A hammer is the only tool required to connect or disconnect it.

It will pay you to look into this NAYLOR combination for your air, water, tailings and ventilating lines. Write for Bulletin No. 59.

NAYLOR PIPE *Company*

1243 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

Beryllium *(Continued)*

Note: The GSA purchase program for domestically produced beryl ore as published in the Federal Register, October 11, 1952, and subsequently amended provides as follows:

1. Ores must not contain less than 8% BeO.

2. The GSA purchasing program will terminate June 30, 1962, or when deliveries under the program total 4,500 short dry tons, whichever occurs first. As of June 1960, GSA stockpile purchases totaled 2,487 tons.

3. Sellers participating in the program must permit authorized representatives of the Government to examine books and records involving transactions related to the program during the duration of the program and three years thereafter.

4. Any producer desiring to deliver ore in lots consisting of one or more railroad carloads shall notify the Commissioner, Defense Materials Service, GSA, Washington 25, DC.

5. Shipments accepted by the Government on the basis of visual inspection shall be purchased at the rate of $400 per short dry ton (20¢ per lb.).

6. Shipments accepted on the basis of sampling and chemical analysis shall be purchased on the basis of short ton units of contained beryllium oxide (BeO) as follows:

BeO content	Price per unit
8 to 8.9%, incl.	$40
9 to 9.9%, incl.	$45
10% and over	$50

Table 14. Processors and Producers of Beryllium Metal and Compounds

Beryllium Corp.
Tuckerton Road
Reading, Pa.

Brush Beryllium Co.
4303 Perkins Ave.
Cleveland 3, Ohio

Table 15. Regional Offices of Department of Interior Office of Minerals Exploration

Beryllium minerals are included in the Government program to stimulate search for and development of additional ore reserves. Information pertaining to this program may be obtained from the following:

Office of Minerals Exploration, Department of Interior, Washington 25, D.C.

OME Region I. South 157 Howard St., Spokane, Wash.

OME Region II. 420 Custom House, 555 Battery St., San Francisco 11, Calif.

OME Region III. Building 20, Denver Federal Center, Denver 25, Colo.

OME Region IV. Room 11, Post Office Bldg., Knoxville 2, Tenn.

Table 16. Possible Buyers of Beryl

Associated Metals & Minerals Corp.
75 West St.
New York, N. Y.

Beryllium Corp.
Box 1462
Reading, Pa.

Beryl Ores Co.
Box 409, Route 1
Arvada, Colo.

Alfred D. Brown Associates Inc.
24 Stone St.
New York, N. Y.

Brush Beryllium Co.
4301 Perkins Ave.
Cleveland 3, Ohio

Continental Ore Corp.
500 Fifth Ave.
New York, N. Y.

Derby & Co. Inc.
285 Madison Ave.
New York, N. Y.

Foote Mineral Co. Inc.
18 W. Chelten Ave.
Philadelphia 44, Pa.

E. A. Godoy & Co. Inc.
25 Broadway
New York, N. Y.

Lapp Insulator Co. Inc.
Gilbert and Mill Sts.
Leroy, N. Y.

Mercantile Import & Export Corp.
21 E. 40 St.
New York, N. Y.

Metallurg Inc.
99 Park Ave.
New York, N. Y.

Pan American Trading Co.
50 Broad St.
New York, N. Y.

Phillip Bros. Inc.
70 Pine St.
New York, N. Y.

Frank Samuel & Co. Inc.
Lincoln Liberty Bldg.
Philadelphia 7, Pa.

J. A. Samuel & Co. Inc.
220 Broadway
New York, N. Y.

A. O. Smith Corp.
3533 N. 27 St.
Milwaukee 16, Wis.

C. Tennant Sons & Co.
100 Park Ave.
New York, N. Y.

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U.S. Bureau of Mines lists 26 Reports of Investigations on Beryllium of which five are out of print; and seven Information Circulars, of which three are out of print.

U.S. Geological Survey has published a Selected Bibliography on Beryl and Beryllium containing approximately 100 listings. The Bibliography includes general titles from various publications, and regional reports for 12 states of the U.S., and for Canada.

How 4 LW tractors help speed removal of 45 million tons of overburden

"LW tractors move fast, keep out of the way of swinging shovels and backing trucks," says pit superintendent at new copper mine, "and they also clean up effectively around shovels as well as leveling and 'sweeping' dumps."

Because of Tournatractor's excellent go-anywhere, do-anything ability, the copper mine uses one of its 4 LW tractors for economical handling of odd jobs. These include general leveling . . . pulling tilt-bed trailers and drills to various locations . . . spotting rail cars (without tearing up ties or road-bed) . . . preparing churn-drill placements . . . and rough-grading of roads . . . moving cable towers . . . and pushing pit vehicles.

In approximately 2 years, owner of this new U.S. open-pit copper mine will remove 45,000,000 tons of overburden to uncover the ore body. 4 LeTourneau-Westinghouse Tournatractors® play an important part in helping meet this tight time schedule. Here's how:

With 218 hp, 17.2-mph speed, and go-anywhere mobility, these LW rubber-tired tractors follow a strict schedule of clean-up and maintenance . . . keep haul roads, load and dump areas clean and smooth 24 hours a day, 6 days a week. Result: stripping shovels and haulers work *steadier, faster.*

"Save on truck-tire replacement"

Tournatractor's performance is also giving the mining firm an *added* bonus: lower truck-tire replacement costs. Says the pit superintendent, "By keeping work areas free of rock with Tournatractors, we are protecting an important investment in truck tires alone. We expect to save a *substantial* sum in tire replacement, always a major expense in this type of operation."

We will be glad to show you how fast-stepping LW Tournatractor can cut *your* costs and increase overall pit efficiency. Ask for complete information and demonstration.

CT-2334-MJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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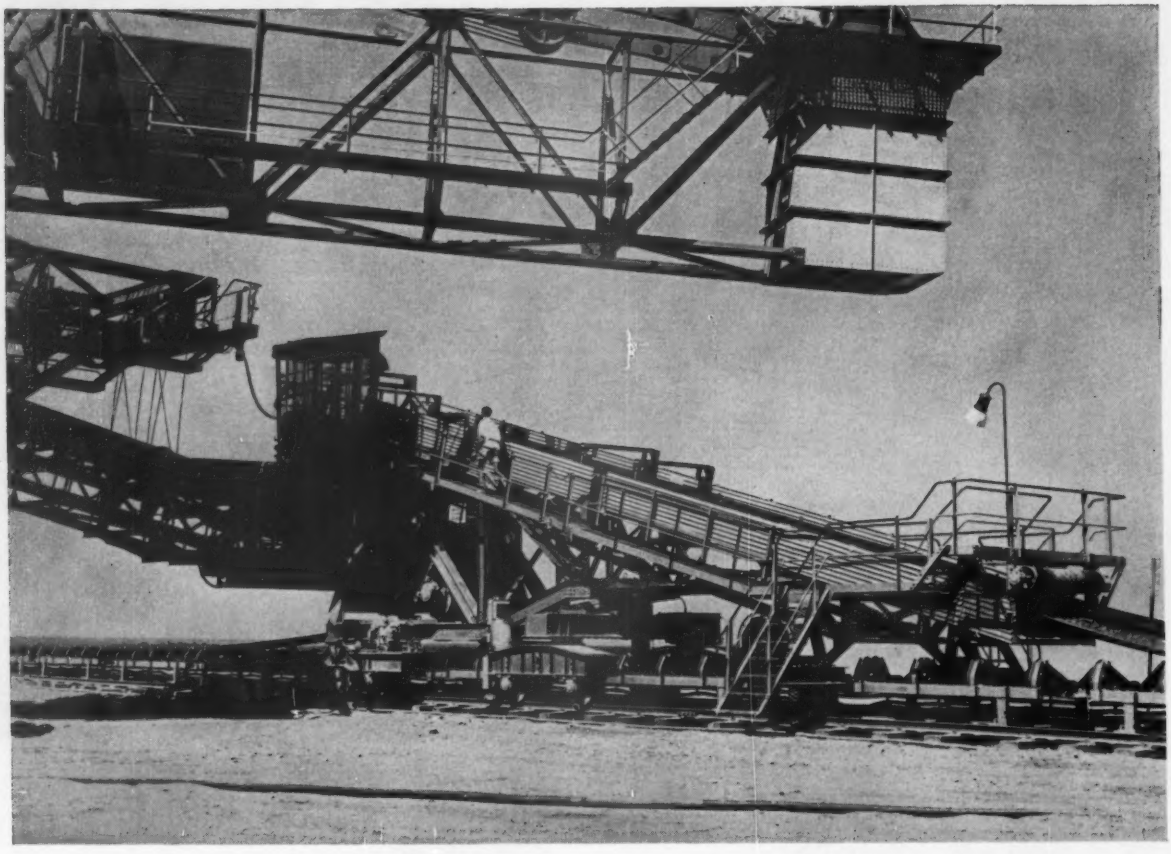
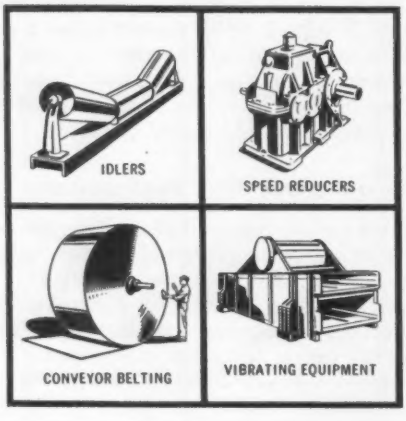


IN AFRICA, TOO,

H-R Conveyors Handle Overburden



Conveying 3000 tons of overburden every hour from the Nchanga Copper Mine in Northern Rhodesia is the grueling task of this 7400-ft. Hewitt-Robins conveyor system. A key unit in this operation at one of the world's richest copper mines is an H-R tripper that:

- Feeds overburden from conveyor to stacker.
- Interlocks with stacker to insure combined movement.
- Travels under its own power when dump conveyor is moved.
- Is engineered to withstand heavy loading, continuous runs.

The superb engineering and workmanship that go into Hewitt-Robins trippers are found in all H-R conveying equipment. For full details consult your H-R representative, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 9-16.

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The name that means everything in bulk materials handling systems . . .

CONVEYOR BELTING AND IDLERS · INDUSTRIAL HOSE · VIBRATING FEEDERS, SCREENS & SHAKEOUTS · POWER TRANSMISSION EQUIPMENT

Ontario *(Continued)*

North Coldstream Mines, which resumed operations at the Kashabowie area copper mine less than six months ago, produced a total of 108,083 tons milled for an estimated 5,080,349 lb copper, 24,700 oz silver and 867 oz. gold. Mill heads have averaged 2.54%, or somewhat higher than the 2.37% calculated grade of reserves.

Can-Fer Mines has indicated another iron deposit on its property near Kowkash in preliminary exploration. Geophysical work outlined an anomaly having a length of about 7,200 ft and an average width of 500 ft. Two drills have cut the formation but assays have not been taken as yet. The company has installed a laboratory at the property for assaying and other metallurgical testing.

Cochenour Willans Gold Mines is headed for another record production year at its gold producing mine in the Red Lake area. In the first half of 1960 output was valued at $1,247,709, up from the previous record of $1,092,394 in the corresponding period of 1959. The company is currently concentrating on opening up the new west zone, which is proving to be a bonanza. It is calculated that the mine has more ore in sight now than at any time since production started 21 yrs ago.

Denison Mines is maintaining production at peak levels from its uranium producing property in the Elliot Lake area. Output in the first six months of this year topped $28-million for net profit of over $10-million. Two dividends totaling $1 per share have been declared for this year to bring total payments by the company to $2 per share. Part of the production is being stockpiled and at June 30, 1960, inventory amounted to $17-million worth of uranium oxide concentrates. At that date some $134-million worth of concentrates remained to be delivered under its Eldorado contract. Deliveries are scheduled to be completed by Dec. 31, 1963, by which time it is expected that a cash equity of $68.8-million, or $15.37 per share, will be available.

A new gold find made by Noranda Mines in the Kenora area has resulted in staking activity by several companies and private interests. The find is located some 60 miles southeast of Kenora. Conwest Exploration Corp., Kerr-Addison Gold Mines and Gunnar Mines are said to be active in the area.

St. Lawrence River Mines plans to start production as Canada's first niobium (columbium) producer as soon as possible, Paul E. Riverin, vice president, said. He estimated the company's patent-applied-for ore concentrating process can produce high-grade niobium concentrates competitively. The firm is now determining potential demand. Ore reserves of the firm and the 77% owned Oka Columbium & Metals are estimated at 17.6-million tons. Oka lies 40 miles west of Montreal.

Macassa Mines, veteran Kirkland Lake gold producer, is continuing its deep development program. The No. 2 shaft is being deepened from present bottom at 4,000 ft to depth of 4,625 ft and plans have been made to extend the No. 2 winze another 600 ft to provide four new levels below the 5,600-ft horizon. Production is running about on a par with last year. Output for the first four months, 1960, amounted to $835,397, compared with $817,823 for the like period last year.

New Dickenson Mines is biting into choice new ore in driving on the 17th level at its gold producing property in the Red Lake area. A length of 100 ft graded 1.5 oz gold ($52.50) per ton across 6.0 ft. Drilling is being done to pick up the faulted extension of the new vein. Production is continuing at record rate reaching a new peak of $1,333,744 in the first five months of this year. Net profit for the period is estimated at $237,446 compared with $174,746 for the same period of 1959.

Exploration of the Pearl Lake porphyries at the McIntyre Porcupine gold producing property in the Porcupine area has indicated 4.5 million tons grading 1.01% copper and 0.016 oz gold per ton between the 1,125 and 2,625-ft levels. Of this total, 3,080,000 tons averages 1.24%

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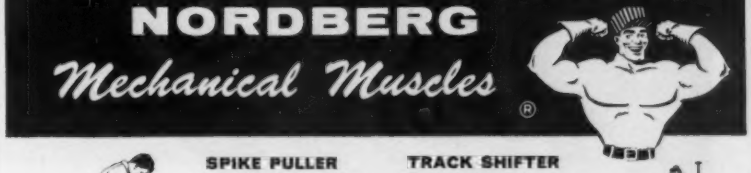

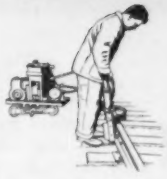

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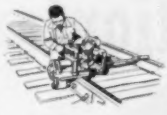

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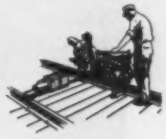

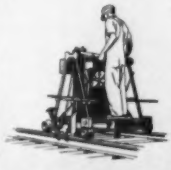

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Ontario *(Continued)*

copper and 0.023 oz gold per ton. The copper zones have been exposed only on the 1,625-ft level. A new internal shaft is to be put down to depth of 1,000 ft below the present bottom level at 6,825 ft and is to be located some 4,600 ft east of the main internal shaft, the No. 14. The program is expected to take about 18 months.

Hollinger Gold Mines is beginning to reap the benefits from its iron ore interests. Income from this source in 1959 exceeded revenues from its gold mining operations in the Porcupine area. Profit from the mine amounted to about $600,000 but after adding iron ore and other income, net profit was $3.3 million, or 67c per share. This compares with net of 49c per share in 1958. Ore reserves at the Hollinger still total close to three million tons, while it is planned to deepen that shaft at the Ross mine another 1,000 ft to open seven additional levels.

QUEBEC

A new continuous pressure leaching process will be used in a $2-million small-scale titanium dioxide production plant planned by Continental Titanium Corp. The new process, developed by Continental's vice president Nicholas Soloducha, is said to be as much as 30% cheaper than present batch leaching processes.

The plant will be located 60 miles east of Quebec City in the Baie St. Paul area. It will use automated techniques to refine Quebec ilmenite ores which are not usable in the batch method. Initial production, in mid-1961, would be 10 tpd of almost pure titanium dioxide.

Dumont Nickel Corp. is continuing to add to indicated tonnage in drilling on the Anglo American Molybdenite Corp. property in Preissac Township. Total estimated tonnage is now placed at 2.24-million tons grading close to 0.50% molybdenum disulphide. Values in bismuth are also contained in this tonnage. Drilling is still in progress.

Barnat Mines has made decided improvement in production and profits this year from its Malartic area gold operations. In the first half of 1960 production totaled $1,000,768, up from $636,980 in the like period of 1959. Tonnage milled moved up from 102,319, or 565 tons daily, to 199,169, or 1,094 tpd. Of the total treated this year, 84,045 tons were milled at Malartic Gold Fields. Operating profit for the 1960 period was $110,296, against $7,090 last year.

Copper Rand Chibougamau Mines has settled down to steady production with results from its Chibougamau area operation in the second quarter of this year showing substantial gains over the first quarter. Milling, which started late 1959, was gradually worked up to rated capacity at the end of the second quarter. Production in the three months ended June 30, 1960, amounted to 6,022,419 lb copper, 2,710 oz gold and 19,362 oz silver from 126,638 tons milled, an average of 1,392 tpd. In the previous three months output totaled 4,514,058 lb copper, 2,150 oz gold and 15,887 oz silver from 95,199 tons, an average of 1,046 tpd.

Following completion of shaft sinking at its Noranda area base metal property, Consolidated Vauze is embarking on a 400-500-ft lateral drive on the fourth or 500-ft horizon to investigate an area in which good copper values were obtained in diamond drilling. An extensive underground drilling program is slated to follow. Shaft has been completed to initial objective of 771 ft. Mining on the B zone, about 200 ft south of the shaft, is not expected to get under way until the present program is completed.

Noranda Mines realized an estimated net profit of $6.1-million from gross revenue of $13.3-million in the first half of 1960. This compares with net of $5.8-million from total revenue of $12.7-million in the corresponding period last year. Copper production is being reduced at a rate of 1% per month toward the previously proposed cutback of 10%. This can be changed depending on market conditions. Output in the 1960 period totaled 25.5-million lb copper and 89,425 oz gold, against 26.1-million lb

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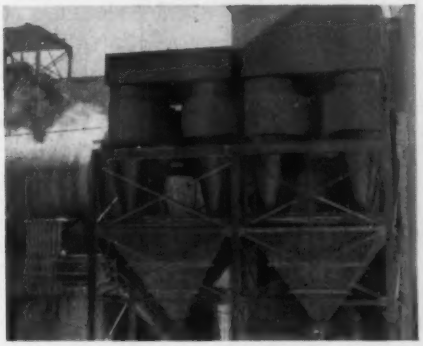

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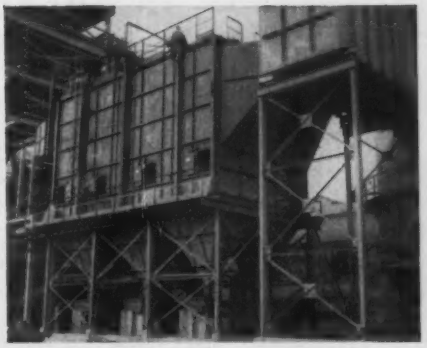

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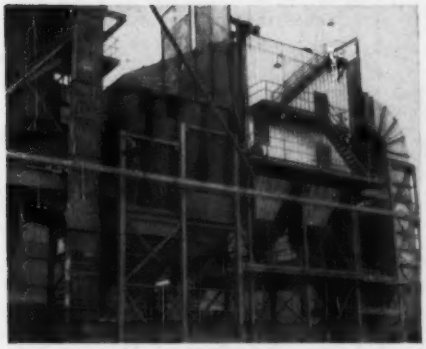

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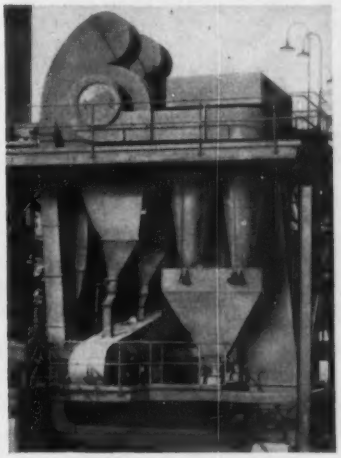

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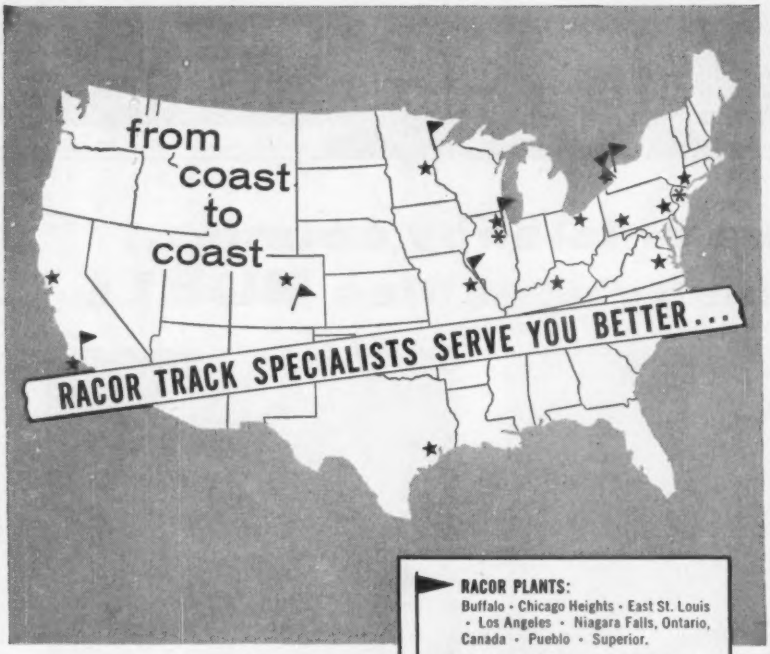

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Quebec (Continued)

copper and 95,473 oz gold in the first half of 1959.

Murray Mining Corp. has more than doubled previous indicated ore reserves in diamond drilling at its Ungava area asbestos property. Reserves are now calculated at about 7.8-million tons grading $20 per ton in the A zone. This tonnage is contained along a 2000-ft strike length with average width around 250 ft. Drilling is being continued, the objective being to indicate tonnage of upwards of 9-million tons before tackling actual production plans.

LABRADOR

Rio Tinto Canadian Exploration has taken a working option from Ventures Ltd. on a property in the Seal Bay area. Previous work had outlined a deposit containing an estimated 0.24% columbium pentoxide and subsequent work indicated beryllium in high grade quantities. Metallurgy and mineralogical identification of the beryllium presented problems and work is being concentrated on their solution.

Atlantic Coast Copper, with senior financing for production arranged, has been obtaining encouraging results in underground work at its Little Bay copper property. Both tonnage and grade have shown improvement over the original estimates. Mill heads are now expected to work out around 2.5% copper against the original 2.1%. Unexpected new ore, running better than average, has also been located in the east end of the mine. The main shaft has been deepened 300 ft to provide two additional levels, or a total of six levels.

IN AFRICA

Original prospecting boreholes sunk by a subsidiary of Rand Mines Ltd. in the Karoi area of Southern Rhodesia have been sufficiently encouraging to warrant continuation of their exploration program. It is reported that five drills are now at work in the area.

Vulcan Minerals (Pvt.) Ltd. has been granted two exclusive prospecting orders over a total of approximately 44 sq miles in an area in the south of Southern Rhodesia. The company is likely to prospect for precious stones and minerals and base metals. A total of £11,000 ($30,800) must be spent within each reservation and the order expires at the end of February 1962.

A hard-to-drill ore deposit is being mined at Pella in Namaqualand on the borders of the Southwestern Cape Province. The ores, corundum-sillimanite, provide one of the finest and hardest aluminum refractories. It is being mined by Pella Refractory Ores S.A. (Pty.) Ltd. The average mineral composition of

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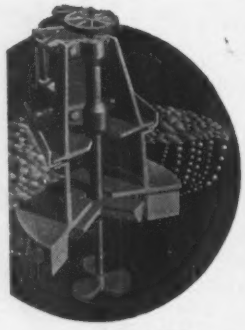

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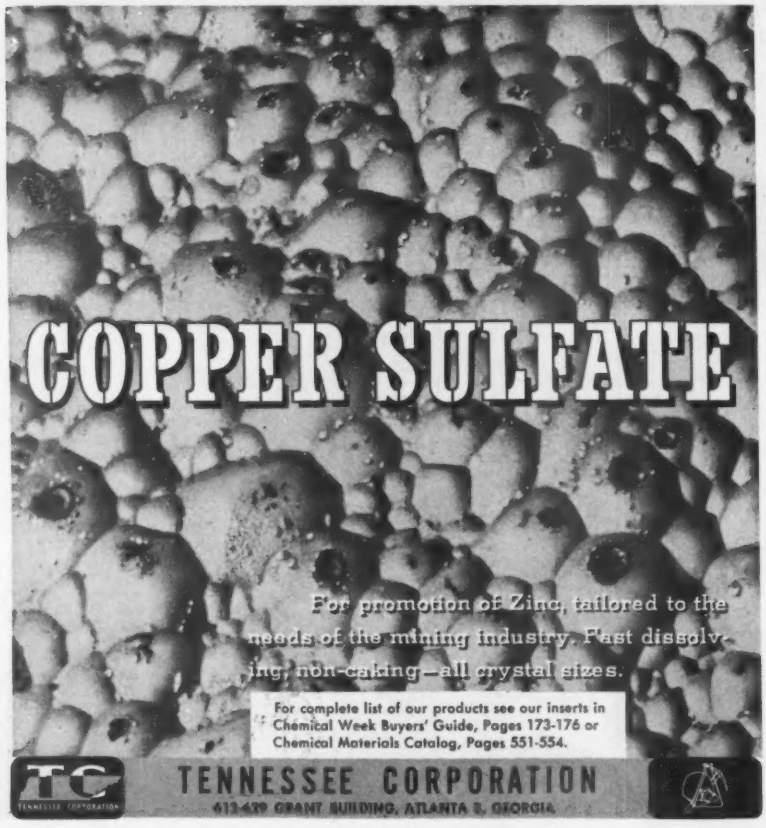
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Africa (Continued)

the known reserve of 400,000 tons in this deposit is: sillimanite, 53%; corundum, 41%; ilmenite, 2.77%; and rutile. 1.19%.

The Japanese have lost interest in nickel deposits at Bindura (Southern Rhodesia). A spokesman of the Anglo-vaal Rhodesian Exploration Co. says that an agreement made last September was only provisional and has terminated.

It was reported last year that Anglo-vaal and a Japanese company, Shimura Kako Chemical Processing, had signed an agreement to build a $2.8-million nickel smelting plant at Bindura.

The South African gold mining industry is well on the way to another record-breaking year.

During the period January-June, the industry shipped more than £158-million ($442.4-million) in export products, which is £12-million ($33.6-million) more than the figure for the first six months of last year. This was made up of gold worth £131.7-million ($368.75-million) and £26.7-million ($74.75-million) worth of uranium oxide.

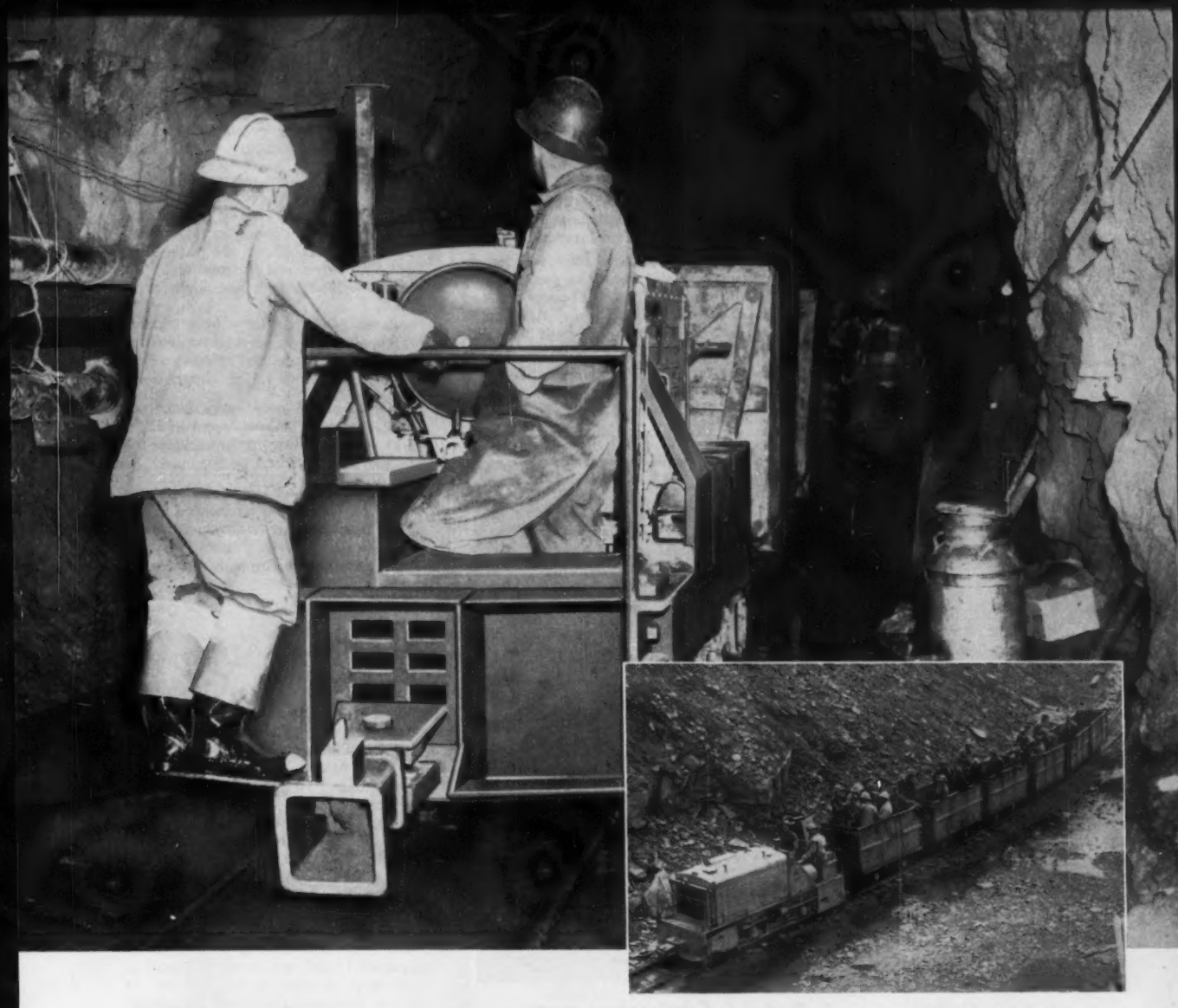
More than 2,400 oz of gold were produced in 1959 by two of the Copperbelt's biggest mines, Nchanga and Rhokana. The gold, produced jointly, was worth $86,522.

The annual report of the Northern Rhodesia Ministry of Labor & Mines for 1959 shows that silver and selenium were produced at these two mines, and that Rhokana produced more than 76,000 lb of uranium.

The following table is given to illustrate the extent and value of mineral production in Southern Rhodesia in 1959 as compared with 1952. The values used in recording mineral production are the "at mine" values.

		1952	1959
Asbestos	tons	84,834	119,600
	$	18,625,530	20,734,722
Gold	ozs	496,731	566,883
	$	18,255,762	19,827,539
Coal	tons	2,821,221	4,143,190
(raised)	$	5,106,603	10,750,337
Chrome	tons	353,135	543,108
	$	5,176,771	8,485,582
Copper	tons	120	12,017
	$	38,539	5,621,638
Tin (concentrate)	tons	57	53
	$	87,671	63,927
Tin	tons	—	641
(metal)	$	—	1,170,162
Other minerals	$	2,187,052	3,355,514
		49,757,929	70,009,422

The value of all minerals produced in Northern Rhodesia in 1959 was $351,484,000—only $14-million less than the record-breaking year of 1956. If the figure was adjusted to take account of a change in the basis of copper valuation, on July 1, 1959, the value of minerals produced would slightly exceed the 1956 record.



PLYMOUTH Mine-O-Motives help set new records at West Delaware Tunnel

A fleet of 17 Plymouth Mine-O-Motives, employed by joint venture contractors Drake-Grafe-Winston-Tecon-Conduit under Project Manager Clancey O'Dell, have helped to establish new hard-rock tunneling records of as high as 85 feet per day on the West Delaware Tunnel near Cannonsville, New York. Working around the clock since the summer of 1956, these Diesel-Powered mine locomotives have seen the most rugged service imaginable for mechanical equipment. Rough trackage, deep water, heavy loads of rock waste, all on a 24 hour schedule to push this 45 mile long tunnel deep through the Catskills for additional water to the New York City water system.

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PHILIPPINES

The largest gold producer in the Philippines, Benguet Consolidated, milled nearly 100,000 tons of ore in June, producing 18,986 oz of gold. The value of the month's output at the official price of $35 per oz was $665,000 but at the free market price of 150 pesos per oz it exceeded $1.4-million. The company reported a very profitable half year, with net income from all sources of $3,282,000 before taxes and charges. This exceeded income during the comparable 1959 period by 26%.

Atlas Consolidated stepped up its milling rate at its Toledo mine in June, treating 271,500 tons of ore and producing 5,613 tons of concentrates estimated to contain 3,111,000 lb of copper. The output represents 29 milling days of operation, or about 9,300 tpd. The stripping ratio has been increased to 4.5:1, all charged to operating expense.

Lepanto Consolidated continued its excellent operating record in June, milling 38,770 tons of 3.48% copper ore and 0.135 oz gold per ton. Total copper production during the month was estimated at 2,580,000 lb.

Surigao Consolidated shipped 1,560 tons of zinc concentrates to U.S. in July. This was the second consignment in an order for some 1,500 tons. Value of the shipment including precious metal content exceeded $230,000.

Itogon-Suyoc Mines, second most important gold producer in the Baguio field, produced 4,212 oz of gold in June, worth $315,000 at the open market rate. Production was about the same from both the Suyoc and Itogon mills, with the first establishing a new high for the mine.

Japanese geologists have been examining copper deposits in Agusan province. The property is reported to have a large indicated reserve of 1.17% copper ore.

The Philippines' only quicksilver producer, Palawan Mines, recovered 256 flasks of quicksilver in June, valued at $54,000, all purchased by Japan.

General Base Metals, the principal manganese producer, has announced it will set up a pilot plant to produce manganese dioxide, for which there is a good local demand. The company's mines are located in Bohol.

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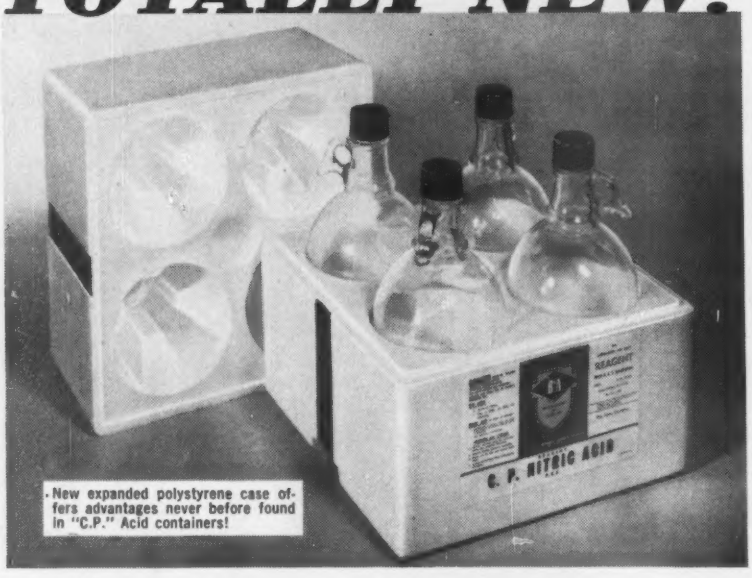

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IN ASIA

A new ferromanganese plant capable of an output of 44,000 tpy will go into production in September in the Dandeli district of Maharashtra, former Bombay state, India.

Sponsored by the privately-owned Khandelwal Ferro-Alloys Ltd., which already operates a 10,000-ton smelter in Dandeli, the new plant's entire output is likely to be bought by Continental Ore Corp. of the U.S. until December 1964. Continental Ore wants an annual 30,000 tons of ferromanganese.

The new plant, starting with an initial output of 15,000 tpy, is not expected to reach peak production till the end of 1962. A new company called Metallurgical Industries is to operate this project.

A framework agreement for the first Iranian metallurgical plant to be erected near Azna has been signed by the Iranian Minister for Industry & Mining, Sharif Emami, and the authorized representative of an Anglo-German syndicate.

The syndicate is led by the West German industrial concern, Demag. Among other members of the group are the West German concern, Krupp, and the British concern, Meeco.

The plant will have a final capacity of 300,000 tpy. The framework agreement, which has been ratified by the Iranian cabinet, contains all principles on the basis of which supply, performance and other agreements are being prepared.

A bill will be submitted to the Netherlands Parliament shortly in order to grant mining concessions in Netherlands New Guinea to a newly established Netherlands-American Ltd. Co. In this new company are: (Dutch) Mining Co. East-Borneo N.V., Netherlands Trading Society, Wm. Mueller & Co. and (Ameri-

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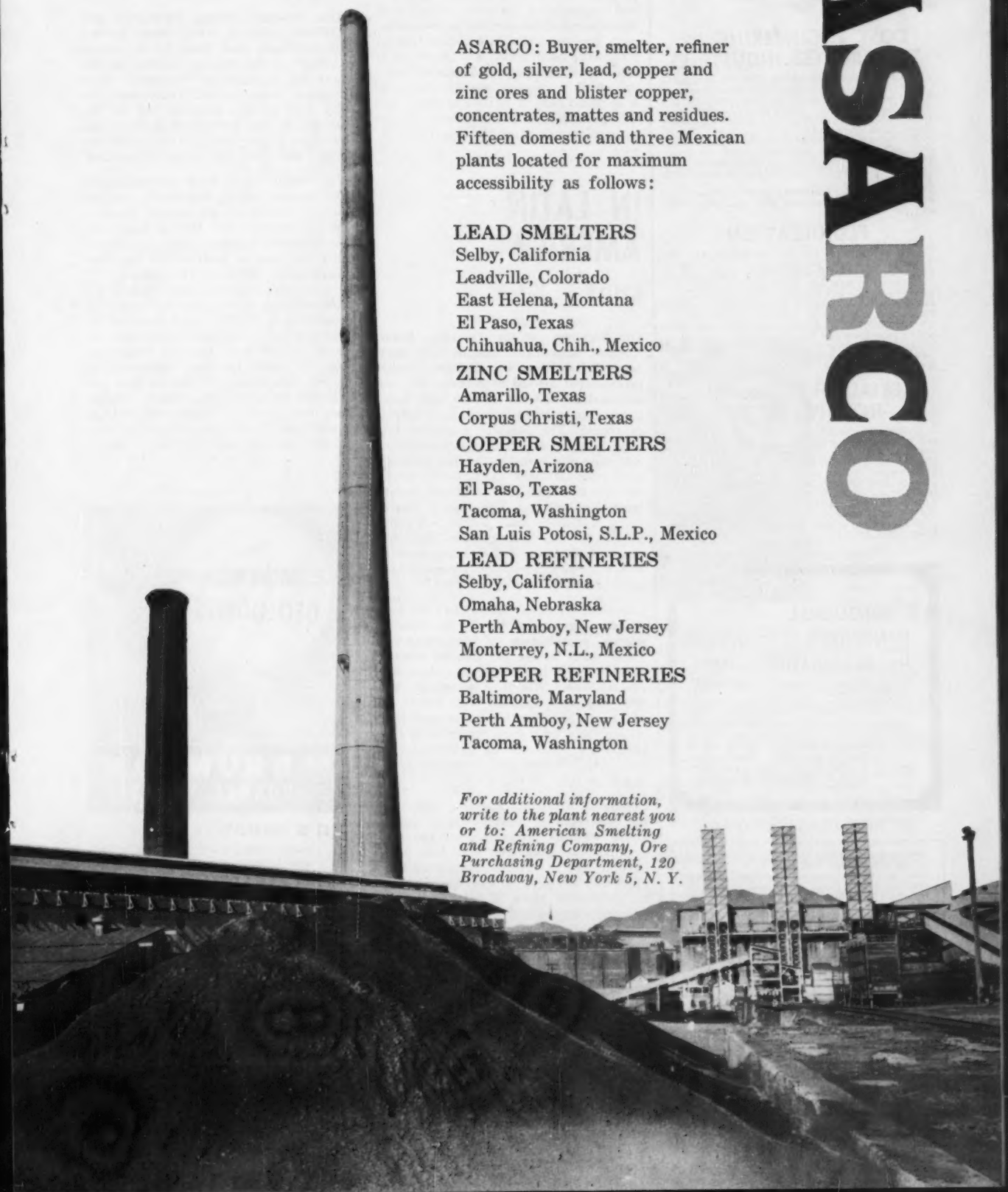
For additional information, write to the plant nearest you or to: American Smelting and Refining Company, Ore Purchasing Department, 120 Broadway, New York 5, N. Y.



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Asia (Continued)

can) U.S. Steel Corp.

The East Borneo Co. has sent expeditions in order to make soil-explorations in New Guinea, the documentation of which seems to be highly satisfactory and encouraging. In three districts of New-Guinea there seem to be good prospects for the nickel and cobalt production, but there have also been made explorations for copper, bauxite and gold, on which no reports are yet available. It is added here in reliable quarters that the participation of the three Dutch companies will equal the one of U. S. Steel.

IN LATIN AMERICA

CHILE

The Secretary of the Treasury, Señor Vergara, announced that he will soon bring before Congress the text of the arrangement arrived at between the administration and the Braden and Anaconda companies to increase their output of copper. The Minister expressed the hope that the expected new production will raise the country's copper production from 500,000 to 800,000 metric tpy of copper and that eventually it will reach 1-million tpy. The amount of the investment to be made by the two companies in this country was not announced. Purpose of the arrangement is to provide new tax income for rebuilding earthquake-torn southern Chile.

Compañía Minera Disputada de Las Condes, now controlled by the French mining organization of Peñarroya, is about ready to fire the Chagres copper smelter which has been down since the end of World War II. This smelter has been improved specially with regard to its charge handling equipment and will reduce the copper concentrates from the company's mills at El Cobre (1,100 metric tpd of ore) and Disputada (700 tpd).

Compañía Acero del Pacífico, owner of the steel mill at Huachipato, is going ahead with its project to get the Algarrobo high grade iron mine into production. The surveys for connecting the mine with the state railroad from Vallenar to Huasco, about 30 miles long, and building a mechanical loading wharf for the iron ore at Huasco harbor are almost finished. Algarrobo is the largest high grade iron mine in Chile with a reserve between 80- and 100-million tons.

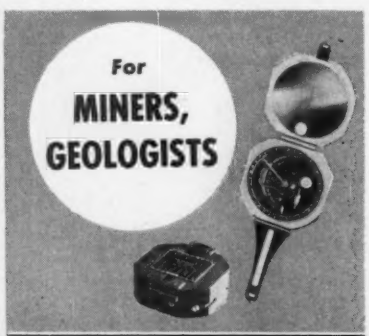
An offer to supply the necessary credit for building a copper refinery at Ventanas has been made by Kloeckner-Humboldt-Deutz, a West German association of machine manufacturing companies. The association previously obtained a contract to supply the necessary machinery for building the new government copper smelter, which is also at Ventanas.

The proposed refinery would have a capacity of 42,000 metric tpy of copper, sufficient to refine the output of both the Paipote and Ventanas copper smelters. The cost of this refinery has been estimated at $4.5-million.

The National Mining Enterprise and CORFO (Chilean RFC) have decided to coordinate their plans for the development of the mining industry in the northern provinces of Tarapacá, Antofagasta, Atacama and Coquimbo. The first part of this program will be the making of the geological plans of the principal mining districts or camps for which the U.N. will furnish $1-million.

The Mining Credit Bank, now known as the National Mining Enterprise, a merger brought about by the present administration between the Mining Bank and the National Smelters Corp., announced that last year it had bought ores and concentrates valued at $13-million.

Low-grade copper ores bought for concentrating in the organization's mills amounted to 216,270 short tons and direct smelting ores, concentrates and cement 154,149 tons. The fine metal content of both tonnages amounted to 27,400 tons copper, 37,500 oz gold and 320,000 oz silver. The Paipote smelter last year produced blister (99.2% Cu) containing 20,112 metric tons copper; 25,600 oz gold and 280,000 oz silver.



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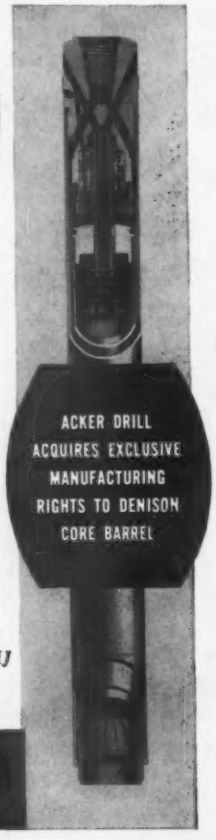

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Chile *(Continued)*

The enterprise has 23 buying depots or agencies where the ores and concentrates are bought from the miners and also maintains 10 assay laboratories. Its executive vice president also announced that his organization has started the construction of the Las Ventanas copper smelter where the concentrates and ores from Central Chile will be reduced to blister copper. The cost of the Las Ventanas smelter will reach $11-million and will be constructed with a loan from the Kloeckner-Humboldt-Deutz Co. The capital of the National Mining Agency amounts to $16-million.

What appears to be an important copper deposit has been discovered recently in Tarapacá province near the old Yabricoya mine, in the localities known as Mocha and Cerro Colorado. The find has been made by personnel of the Instituto de Investigaciones Gológicas working in collaboration with geologist of Point Four.

GUATEMALA

Preliminary work on titaniferous iron deposits near the Pacific coast has gotten under way. In a ceremony at the port of San José attended by Guatemalan financial and industrial leaders, the program was launched by a firm known as "Arenas Titaníferas del Pacífico, S. A."

According to the report, analyses made in Germany, France, England and the U. S. show that the sands of the Pacific coastal area of Guatemala contain iron ore to an extent of 50%. It is reckoned that at the start, the company will export half a million tpy of iron ore concentrate. It is hoped eventually to bring exports up to 2-million tpy.

MEXICO

Sheep Creek Mines Ltd. has obtained an option from Alamos Mines Ltd. to examine the Promontorio mine at Alamos, Mexico. The company has until the end of August to make a decision for production. Alamos has been developing the property for two years and has made some shipments of development ore to Mexican smelters. Don McLean, mine manager, reports a 27 ft advance in the Veta Grande vein on the main-haulage level, 350 ft below the surface.

EL SALVADOR

The newspaper Diario Latino reports that a representative of the Coronado Corp. has returned to New York after studying possibilities of reopening El Salvador's last producing gold-silver mine, the Mineral Montecristo, in the province of Marozán.

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El Salvador (Continued)

Swiss firm based in New York, with head offices at Basel, Switzerland. The Insafop (Salvadoran Institute to Foment Production), which lent $440,000 in various installments to the Salvadoran-owned mine over a period of several years in an effort to prevent closing down the property, recently disclosed that the Coronado Corp. was interested in the mine, but gave no details.

BRAZIL

The Brazilian firm Distribuidora—Exportadora de Minerios S.A. (Dema) is investing $1.5-million in a plant to process columbium deposits in Araxa, Minas Gerais, for export. Production is scheduled to start in February or March next year.

Company spokesmen say the deposits assay at an average 3.5% columbium against 0.4% to 0.7% for similar deposits in Africa and Canada. Dema is 50% owned by Mineracao Wahchang S. A., Brazilian subsidiary of the Wah Chang Mining Co. Wah Chang reportedly is working on a sales agreement for columbium concentrates with Molybdenum Co.

IN EGYPT

The Soviet Union will provide mining experts and $4.2-million worth of equipment for geological and geophysical exploration and mining prospection to a maximum depth of 1500 meters in the Eastern Desert and Sinai peninsula, which have been divided into eight exploration zones.

The Ministry of Industry has announced exploration will proceed for 13 minerals in the eight zones:

- Wadi Alaki area: iron ore, graphite, copper
- Berniss and Zirket Naam area: ilmenite, wolfram, chromium
- Sambuki area: copper, lead, zinc
- Al-Dibah and Abu-Mirwat: iron ore
- Gebel Qattara: manganese, sulphur
- East of the Nile Valley (Central Egypt): phosphate
- Northern Sinai: coal, phosphates
- Central Sinai: coal, copper

IN EUROPE

Recent discoveries of copper deposits in Bulgaria made it possible to step up the plans for electrolytic copper as follows:

Year	Original Plan	Revised Plan
1962	17,000 tons	23,000 tons
1965	25,000 tons	30,000 tons

A corresponding rise in the output of blister copper will also take place. In order to meet these revised targets, the Georgi Damyanov plant is being extended to double its initial capacity by the end of this year, and to treble it by the end of 1965.

Intensive geological surveying and prospecting for copper ores are being conducted throughout Bulgaria. Working of new deposits has already resulted in a spectacular rise in the quantity of ore extracted. Output of copper ore was:

1945 25- to 30,000 tons
1959 over 1-million tons

In 1958, Bulgarian copper production was limited to 6,100 tons of blister copper. The foundations of a modern copper industry were only laid when the new Georgi Damyanov Works was completed at the end of that year. During its first eleven months of operation, this plant produced 80,000 tons of copper.

IN USSR

Development of iron from the rich Kursk magnetic anomaly will enable the Soviet Union "within a few years" to meet requirements of Communist countries and also to export "considerable quantities" to other countries in Europe and Asia, according to Pyotr Antropov, Minister of Geology.

The Kursk anomaly, according to Soviet geologists, is 125 miles wide and 435 miles long, extending to the northern edge of the Donets coal basin.

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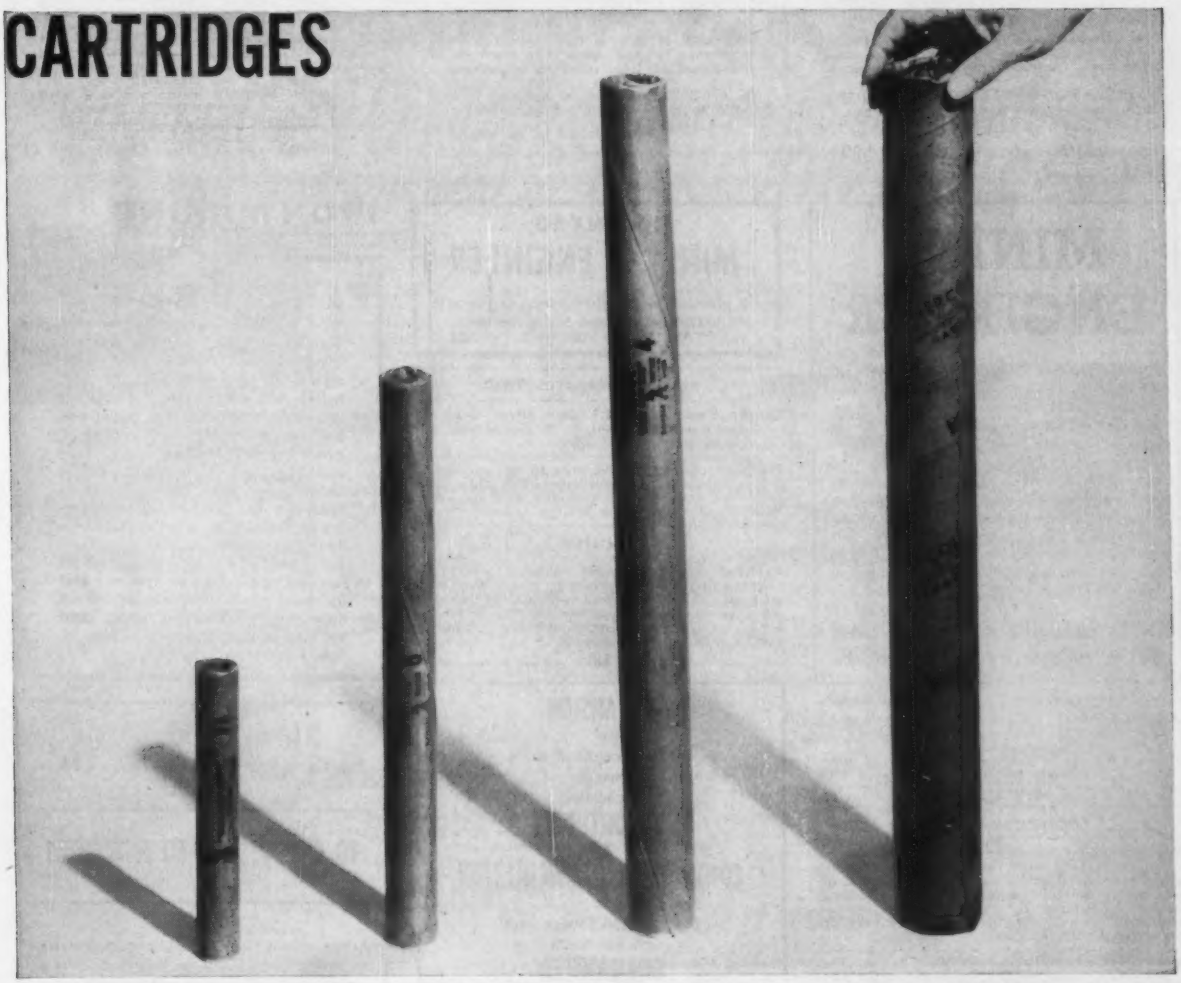

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Cartridge strength, %	48	50	34	19
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Mr. Employee you, too, can help by acknowledging applications and job offers. This would encourage more companies to answer position wanted ads in this section.

We make this suggestion in a spirit of helpful cooperation between employers and employees.

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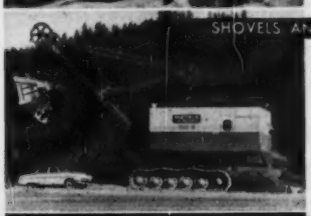
2 miles long, 42" wide rubber belt. 9 flights, available individually, ranging from 672 ft. long to 1885 ft. long. Braking by electric motors acting as generators under belt load; also mechanical brakes. System includes drive-over hopper loading station for scraper discharge, screening and crushing plant, three drive-under terminal bins with total capacity of 1500 cu. yds.

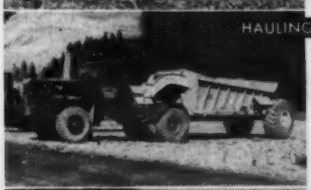


SHOVELS AND CRANES

2—Model 150B Bucyrus Erie 6 cu. yd. Electric Shovels and Draglines (Note: 8 cu. yd. Dippers w/handles available for above); 1—Model 120B Bucyrus Erie 5 cu. yd. Electric Shovel and Dragline; 1—Model 38B Bucyrus Erie 1½ cu. yd. Shovel, Dragline, Backhoe, diesel; 1—Model 22B Bucyrus Erie ¾ cu. yd. Shovel, Dragline, Backhoe, diesel.

MOTOR PATROLS

9—Model 12 Caterpillar Motor Patrols, 8T, 80D, 70, and 71D Series.



HAULING UNITS

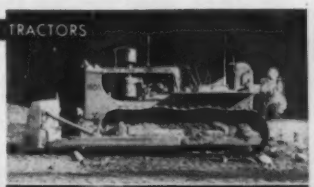
8—Model LRVX Mack Tractors w/Model 137W Euclid 30 cu. yd. Bottom Dump Trailers powered by NVH-12-B1 Cummins Engines; 10—Model PH95AC International Payhauler Tractors w/Model PW20 30 cu. yd. Athey Bottom Dump Trailers.

END DUMP EUCLIDS

5—Model 46TD Euclid End Dump Units, 15 cu. yd., powered by Model NHRBIS Cummins Engines; 10—Model 63TD Euclid End Dump Units, 15 cu. yd., powered by Model 6-110 GMC Engines.

LOADERS

1—Model 175ADS Michigan 3 cu. yd. loader powered by Model 135DKBS Waukesha Engine; 1—Model D4 Caterpillar Loader w/Model EA4 Trackson Loader.



CRAWLER TRACTORS

15—Model D9 Caterpillar Tractors w/P.C.U.'s and Dozers, 18A Series (Note: 4—Ateco Hydraulic Rippers available for above); 21—Model D8 Caterpillar Tractors w/P.C.U.'s and Dozers, 14A Series (Note: 6—Caterpillar #8 Hydraulic Rippers available for above).

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30—Model DW20 Caterpillar Tractors w/Model 456P Modified Scrapers, 67C and 88E Series; 10—Model DW20 Caterpillar Tractors w/Model PW20 Athey Wagons, 88E Series; 2—Model 33LDT Euclid Tractors w/Model 32SH Scrapers.

QUARRY DRILLS

1—Model TWM2A Joy Quarry Drill w/T500 Drills, pneu. tires; 3—Model TWM-5 Joy Quarry Drills w/T500 Drills, pneu. tires.

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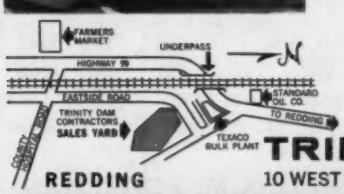

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1—4'6" x 4' Hirsch Ball Mill
1—4' x 54" Hirsch Ball Mill
1—64½ Marcy Ball Mill
1—8' x 22' Hardinge Conical Pebble Mill
1—3' x 7' Morse New Rod Mill
1—5' x 10' Denver Ball-Rod Mill

MINE HOISTS—SINGLE DRUM, ELECTRIC
1—20-HP H&B
1—25-HP Vulcan #1½
1—25-HP Vulcan #2½ with Gas Engine or Electric Motor Drive
2—40-HP Vulcan
1—50-HP W.A. Box
1—100-HP Liderwood
1—100-HP W. A. Box
1—112-HP Vulcan
1—150-HP Vulcan
1—150-HP Ottumwa
1—250-HP Ottumwa
1—300-HP Liderwood Cableway Hoist

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1—75 to 100 HP Vulcan
1—75-100-HP, Clutched Drums, Post Brakes
1—82-HP Vulcan #5½
1—100-HP Webster, Clamp & Lane
1—150-HP Jackson
1—52-HP Minneapolis

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1—F-211 Sullivan Double Drum Air Slusher
1—F-212 Sullivan Double Drum Air Slusher

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1—2" Vac-Seal neoprene lined.
3—2" Wilfley.
1—2" Denver.
1—3" Wemco.
2—4" Wilfley.
2—4" Allen-Sherman-Hoff rubber lined.

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1—1½" Economy 4 stage
1—2" American 2 stage
1—2" Byron-Jackson 2 stage
1—2" Hill 4 stage
1—2" Union 6 stage
1—2½" Buffalo 4 stage
4—2½" Pennsylvania 4 stage
1—2½" Pacific 6 stage
1—3" Worthington 2 stage driven by 100 HP G.E. Motor, 500 GPM, 550' head
1—3" Allis-Chalmers 3 stage
1—3" Hill 3 stage
1—3" Buffalo 4 stage
2—3" United 5 stage
3—3" United 6 stage
2—3" Union 6 stage
1—4" Platt 2 stage
1—4" Ingersoll-Rand 2 stage 4-T2 driven by 300 HP G.E. Motor, 1000 GPM, 920' head
1—5" Manistee 8 stage
1—6" Byron-Jackson 4 stage driven by 500 HP G.E. Motor, 1000 GPM, 1600' head

AIR TUGGER HOISTS
2—Ingersoll-Rand Model EUA
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3—Ingersoll-Rand Model HU
2—Ingersoll-Rand Model 10H
1—Sullivan Model HA3
4—Ingersoll-Rand Model 1H
1—Ingersoll-Rand Model DU
1—Sullivan Model L-111
3—Ingersoll-Rand Model DSU
13—Sullivan Model E-111

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13—Diester-Overstrom Super Duty No. 6 Standard Size Tables with steel underframes.
8—Dunham Economy Type Tables, 36" x 11'9" decks.

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1—5-HP Sullivan Single Drum, Model DE
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1—3 Ton Ruth Diesel Locomotive with scrubber, 24" gauge.

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1—16" x 10" McFarlane.
1—40" x 20" Cedar Rapids.

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1—1 Ton General Electric
1—3-4 Ton GE Type LSB-2C4
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2—6 Ton General Electric, type LSBE-2C6
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2—8 Ton General Electric, type LSB-2C8
1—8 Ton Goodman, type 42C04T
3—8 Ton Ironton, type WO
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4—10 Ton Atlas, type A

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1—10' x 11' x 175' Vulcan rotary kiln
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2—8' x 40' Stearns-Roger dryers
1—7'6" x 62' rotary kiln, ½"
2—7' x 60' Bonner dryers, ⅞"
1—7' x 50' Allis-Chalmers dryer, ⅝"
1—6' x 7' x 100' rotary kiln, ½" shell

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1—Kennedy 7' x 9' ball mill 150 HP
1—Hardinge 10' x 48' conical ball mill
2—Hardinge 7' x 36" conical pebble mills
3—Hardinge 6' x 48" conical ball, 75 HP
1—Hardinge 4'6" x 16" conical ball mill
1—Allis-Chalmers 5' x 5' ball mill, 75 HP
3—Allis-Chalmers 5' x 22' ball-tube
1—Allis-Chalmers 6' x 16' ball-tube
8—Jaw Crushers: 20" x 6", 18" x 9", 36" x 15", 13" x 24", 10" x 8"

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One 53" x 36" double clutched drums, 75 H.P. or 200 H.P.

One 72" dia., 40" face, both drums clutched, 1¼" rope, 880 FPM, 500 H.P.

One Nordberg double clutched drums, 10' dia., 10' face, 1½" rope, 1250 H.P., 1200 FPM.

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900 H.P. Vulcan DD, 1820 FPM, 3/60/2200
200 H.P. Flory DD, 550 FPM, 3/60/440
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1—6" x 4'6" Denver Laboratory, Spiral
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14—No. 6 Deister diagonal Deck.

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1—6 Cell Wemco Size 44" x 44", Excellent

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4—30NM3C Ing. Rand, 2 drum 30 H.P. 440 V.
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1—BF212 Sullivan, 2 drum, 20 H.P., 440 V.
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1—CA 311 Sullivan, 3 drum 50 H.P. 440 V.
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1—GB Memco-Hope Dry Magnetic, 3-cross belt, 115 V.

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Two Used Hazelton Type "OT" 8" Dredge Pumps with N1-Hard wearing parts, fitted with 8-Groove "C" Section 20-0" P.D. Sheave, Overhead Motor Mounting base and V-Belt Motor Guard—less Motor, Motor Sheave and V-Belts.

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9 Gen. Elec. 20, 25, 45, 65, 80 & 100 Ton
25—Ton Industrial Brownhoist, 60' Boom Crane

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2—5x8 KVS Air Swept Ball Tube Mills
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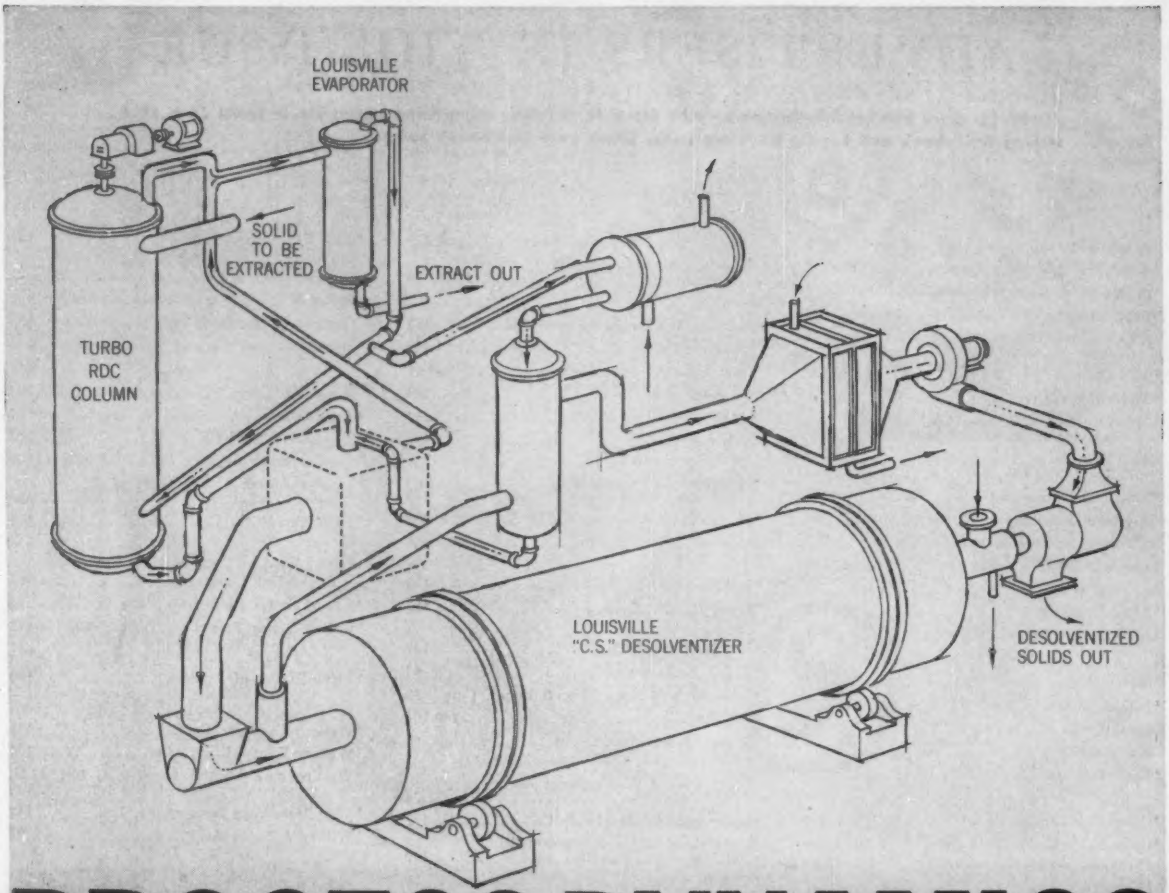

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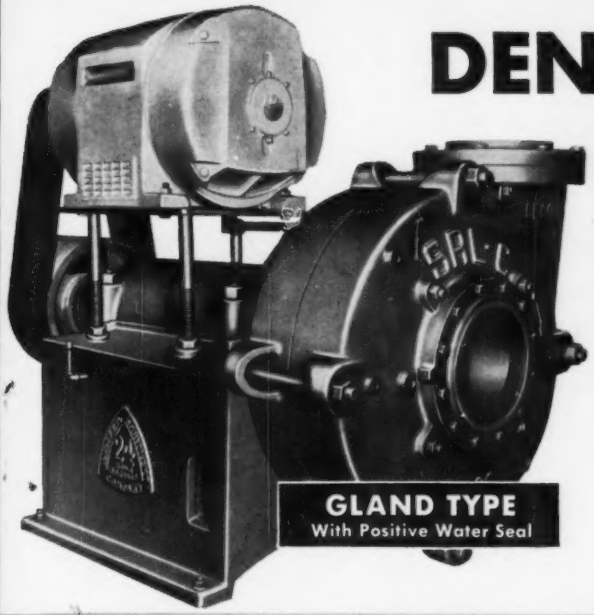

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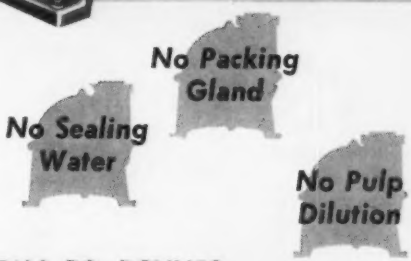

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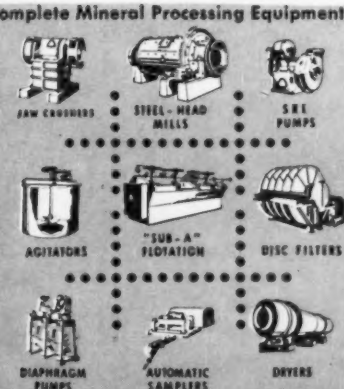

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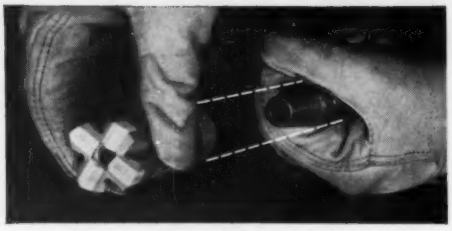

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